

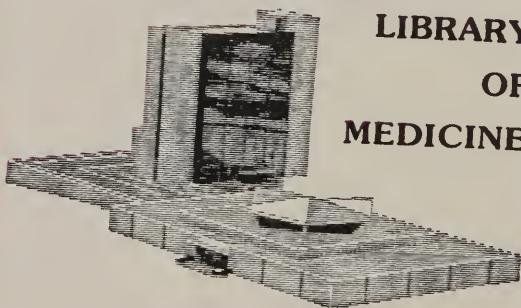
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A REPORT
ON THE
PROGRESS OF SURGERY

MADE TO THE
ST. LOUIS MEDICAL SOCIETY.

By E. A. CLARK, M. D.,

PROFESSOR OF PRINCIPLES OF SURGERY AND SURGICAL ANATOMY IN THE MISSOURI MEDICAL
COLLEGE, CHAIRMAN OF THE COMMITTEE ON SURGERY.

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ANNUAL REPORT.

MR. PRESIDENT:—As chairman of your committee to prepare an annual report on the progress of surgery, for this Society, we would suggest that, in consideration of the readiness with which all our current medical literature is attainable by every member of the profession, who desires it, and the intelligence and professional attainments of the gentlemen constituting this body, it would be scarcely less than arrogance on our part to expect to furnish anything new, or that is not generally known on this subject. We shall, therefore, only attempt to condense the more rational views bearing upon a few of the subjects which are more prominently before the profession at the present day. Of these we shall speak first of

ANEURISM.

The methods of treatment for aneurism are so numerous and varied, that, to mention them all, would be quite out of place in this paper. We shall, therefore, only allude to such as have more recently seemed to meet the approbation of the profession, and such new methods as seem to indicate a degree of success in the future. Yet, with all this, we do not presume to ignore the practice of former days, when the ligature, immediate and remote, both proximal and distal, with incision into the sac, was the common rule of treatment in certain cases, which may still occur in ordinary practice, and, in which, especially the Hunterian method of ligation is more applicable than many of our

more modern improved methods. But as we shall not venture farther upon these methods of treatment, we will notice first that by

ANEURISM.

The treatment of aneurism by compression, which at the present time is so deservedly popular, cannot be considered a new method with the older members of the profession; but since its revival by Prof. Mapother, of St. Vincent's Hospital, Dublin, we are willing to accept the treatment as something new in modern practice, superseding in a great measure the ligature, knife and injections into the sac, as also other methods of operative procedure, where compression can be resorted to. In all such cases it certainly possesses advantages over every other means of treatment, inasmuch as it is attended with no danger to the patient, since the force of the pressure, and consequently the amount of the arrest in the circulation, is entirely under the control of the surgeon, and can be modified to any degree within the limits of safety to the patient, which cannot be said of the more radical methods by the ligature, knife or injections. The evidence in favor of this treatment, as reported by some of our most prominent surgeons, is such as to warrant its application in all cases where it can be resorted to, with the assurance that it will almost assuredly obliterate the sac by coagulation where the state of the blood is such as to induce that condition by any other means.

As to the manner in which the compression should be applied, we do not attach much importance, so that the circulation is sufficiently retarded to form a coagulum in the tumor of such consistence as may permanently arrest the flow of blood through it. The question of proximal and distal compression, which has been discussed somewhat, does not bear upon the result in either application, except in certain cases where, perhaps, a collateral vessel of considerable size may be given off, within the tumor or near to it, on its proximal side, when evidently distal compression could scarcely be expected to take place from so slight an arrestion would be inapplicable, for the reason that the coagulation

of the circulation through the tumor. With this exception from the practice now in general use, we do not observe any particular preferences for either proximal or distal compression; though, in cases where there are no collateral vessels in the immediate proximity of the tumor, we should be disposed to favor the distal compression as offering a better result, from the fact that the blood, while regurgitating from the tumor, would likely be to form a more permanent organization of fibrin, whereas the coagulum from proximal pressure consists of all the elements of the blood arrested in the tumor at the time the compression is applied, a part of which is not permanent and cannot be relied upon in all cases, without the security of distal pressure continued while the perishable elements—so to speak—of the clot are being absorbed.

The means of compression we think most generally used, and which in our hands has been most efficient, is by the tourniquet, of which we think those of Dupuytren and Erichsen are perhaps the most applicable in the majority of cases—especially Dupuytren's upon the extremities, and Erichsen's upon the abdominal vessels. Digital compression, we are disposed to think, from the experience of others, is impracticable in the most of cases where a tourniquet can be applied, from the fact that the pressure is concentrated upon so small a surface and so irregular in the force exerted—frequently being increased to twice the amount necessary; while the friction caused upon the skin by moving the thumb from one position to another—which the operator will naturally do for rest—soon excites such an irritation upon the surface and in the tissues beneath, that the patient cannot be induced to tolerate it more than a few hours at most. In this particular our experience has been such as to fully concur with those who have resorted to the method and been compelled to abandon it for the reasons we have already given. Yet, with all this, in localities where the tourniquet cannot be applied, we should be disposed to resort to digital compression, in preference to any other method, even though it should inflict such an amount

of pain upon the patient as to necessitate the administration of chloroform.

In addition to the methods of treatment we have already mentioned, we might refer to that, frequently mentioned by Mr. Simpson, of manipulating the aneurismal tumor for the purpose of detaching any fibrinous organization from the walls of the sac, in order that it might become lodged in the mouth of the distal vessel, and thus arrest the circulation in the tumor. This method, in conjunction with flexion and compression, was recently practised successfully by Dr. Blackman, of Cincinnati, as we shall notice hereafter.

Mr. Mapother has recently reported two cases of aneurism permanently cured by pressure—one, of the popliteal artery, in which pressure was applied to the femoral artery for $9\frac{1}{2}$ hours, when the pulsation ceased entirely, and the patient was relieved of all pain at the site of the tumor. From his description of this case, we judge that the circulation was entirely arrested in the artery during this time. The other case was one of ilio-femoral aneurism, cured in four and one-half hours, by compression upon the common femoral artery.

Sir Henry Thompson also reports one case of popliteal aneurism cured by pressure upon the femoral artery, applied near Poupart's ligament, in twenty-eight hours; that is, the tumor ceased to pulsate in that time, though the compression was continued moderately for four days after the tumor ceased to pulsate, when the patient was reported cured.

Mr. Bryant has also recently reported a case in which he successfully treated aneurism of both popliteal arteries by digital compression—one in four hours, the other in twenty-four hours—the pressure applied upon the femoral artery, which in the latter case was exerted by the patient himself.

Prof. Blackman, of Cincinnati, reports a case of popliteal aneurism successfully treated by flexing the knee at an acute angle, and resorting to digital pressure both above and below the tumor, while he also manipulated the tumor so as to detach any deposits upon its walls that might occlude the mouth of the distal vessel, and thus assist in arresting the course of the circu-

lation through the tumor. In this case, after the compression was discontinued, the limb was kept in the flexed position for several hours, when the aneurism was pronounced cured. Six weeks after this patient was discharged, he presented himself again, when all the symptoms of his aneurism were relieved, and there was no more pain or pulsation in the tumor.

Mr. Verneuil has recently communicated to the Academy of Medicine, of Paris, a case of popliteal aneurism occurring in a diabetic patient, in which he effected a cure by continuous flexion of the knee joint for several days. Though we have not referred to this method of cure, it is doubtless applicable in many cases of aneurism occurring in close proximity to joints where flexion can be practised; yet we think upon the whole, that direct compression is more desirable in all such cases, as the circulation is arrested in this method of flexing the vessel upon itself, by exactly the same principle involved in compression, while the patient is compelled to suffer much more pain, which, if the flexion is continued for a considerable length of time, will exhaust his endurance.

OTHER METHODS.

Dr. Wilhelm Koch, assistant physician at the surgical clinique at Lubingen, reports one hundred and twenty-three cases treated by various methods, the results of which we shall mention in the following synopsis of his report.

He states that the therapeutic trials to remove subclavian aneurism may be grouped under two heads: the one, embracing all the *encheiroles* which were calculated to cure without resorting to ligature; and the other, the different methods of ligature.

To the first method belongs Valsalva's, which consists in the total abstinence of the patient from food, inducing a condition of almost complete inanition; also compression, manipulation, galvano-puncture, the injection of persulphate of iron and cauterizing paste. The most dangerous of these in the hands of Dr. Koch proved to be the persulphate of iron and the cauterizing paste, which, with a single exception, caused suppuration of the

walls of the sac, with fatal consequences from hæmorrhage; and the case of recovery was the merest accident, and not owing to any merits due to the treatment. The danger of suppuration seemed also to attend the operation of galvano-puncture to a considerable extent, as the doctor states it occurred in five cases twice. In two other cases the treatment did not seem to impede the growth of the aneurism; and only once, in a rather small aneurism, by the additional application of ice and compression, was a cure effected by this method.

If we take into consideration now, that the two methods were employed almost exclusively in aneurism of such arteries as the facial, temporal and supraorbital—consequently the less dangerous varieties—and that the trials made in aneurisms of large arteries proved mostly fatal, it certainly seems advisable to abandon these methods in the subclavian arteries entirely. Dr. Koch also states that just as little, can direct compression of an aneurismal sac be recommended. So frequently was this mode of operation in other aneurisms followed by rupture and suppuration, that those cures effected in the subclavian artery—two of which occurred after gangrene of the sac—cannot be regarded as the rule in such cases.

By Valsalva's method, this writer states that three, out of seven cases, were perfectly cured; in one case the growth of the aneurism was impeded by digital compression and manipulation; and again in three cases the result was transitory or negative.

By Furgusson's method—*i. e.*, by manipulating the tumor—this author reports four out of six cases cured, one benefited, and one died.

Dr. Koch reports still more unfavorable results from the treatment by ligature. Of fifteen cases treated by the peripheral, or distal ligature, none were radically cured; though the ligature of the carotids seemed to promise the best result, since in cases where it was practised it gave comparative relief for several months. The ligature of the subclavian artery, above or below the clavicle, which in this report was stated as having been performed six times, was less successful than ligature of the com-

mon carotid. Of the six patients operated upon, five died within one month, and one was never heard from.

The merits of Brasdor's operation—which consists in the simultaneous ligation of the carotid and subclavian arteries, has not yet been fully determined, though of three results reported one died five, and the other six, days after the operation; the third was well a year after. Dr. Koch, in speaking further of subclavian aneurisms, says that, although the peripheral operation seems only to prolong the patient's life for a short time, still we have to resort to it whenever Valsalva's method has failed. Generally the best plan is to ligate the carotid even in case it does not pulsate at all, or but feebly. Ligation of the artery at the proximal side of the aneurism furnished ten cures out of fifty-one cases (not quite twenty per cent.). The ligation placed outside of the scaleni muscles, after Anal's and Hunter's method, could not prevent suppuration of the sac and hæmorrhage. The most effectual of all proved to be the operation between the scaleni. Out of five cases, three were cured. Dr. Koch then reduces the treatment of subclavian aneurism to two plans, owing to whether the tumor is situated external or internal to the scaleni muscles. In the first instance digital compression and ice are advisable; then, if this is of no avail, direct ligation after previously splitting the sac. The results of the Hunterian operation are so unfavorable that it is our duty to try whether this mode of procedure, recommended so zealously by Mr. Syme, will attain better results. Aneurism inside of the scaleni are to be treated by Valsalva's method, with additional digital compression of the peripheral portion of the artery, and with cold. As a last resort the ligation, after Brasdor and Wardrop, may be recommended.

Now, although pressure seems to have almost entirely superseded the ligation as a principle in the treatment of aneurism, there are still other methods which come to us from such creditable authorities that we are bound to receive them with considerable credence. Prof. Langenbeck, during the past year, has reported two cases of aneurism treated by the hypodermic injection of ergotine. From the well known influence of ergot in

exciting contraction of the organic muscular fibres of the uterus, he supposed that a similar result might be produced upon the muscular coats of the arteries in aneurism by hypodermic injections.

The first case treated in this way by Prof. Langenbeck was a man forty-five years of age, who had a subclavian aneurism, which had been treated three years previously by repeated applications of moxa, as recommended by Mr. Jacobsen, which had the effect to diminish the tumor very much until the end of the third year, when it became suddenly enlarged and painful. Three centigrammes of the aqueous extract of ergot were then injected over the tumor, with almost immediate relief of the pain. Within the following six weeks he injected about thirty grains of the ergotine, with the effect of almost entirely relieving the venous congestion and paralysis of the arm, while the tumor was considerably shrunken and the pulsation sensibly diminished, though a complete cure was not effected. The second case was one of aneurism of the radial artery immediately above the wrist joint. In this case about one-fourth of a grain of the aqueous extract of secale dissolved in equal parts of glycerine and alcohol, was injected into the skin above the tumor, when on the following day the tumor seemed to have entirely vanished, with nothing remaining except a local erythematous inflammation, which only continued for a few days.

Dr. George Balfour, of Edinburgh, reports a collection of fifteen cases of aneurism, treated by the administration of iodide of potassium given in large doses and continued for a considerable length of time. In one case of aneurism of the aorta, treated by himself, he continued the remedy almost constantly for nearly two years, when the patient was discharged apparently cured, with but slight pulsation in the tumor and the pain permanently relieved. Mr. Balfour states that by the fifteen cases collected by him, in which the treatment by the iodide of potassium was persistently carried out, there was marked relief in all, except one case, which was hopeless in the beginning. In twelve of the cases there was evident diminution in the size

of the sac, while in a few there was complete subsidence of the tumor, and, to all appearances, a perfect cure.

Mr. Nelaton also reports a case of aneurism of the arteria innominata, involving the aorta, in which he resorted to the use of the iodide of potassium, and, to his great surprise, found that in a few months the aneurism had almost entirely disappeared, and the patient was able to return to his usual occupation without suffering the least pain or inconvenience.

Dr. Chuckerbutty, of Calcutta, while treating a patient with iodide of potassium for a considerable length of time, for an obstinate cough, was surprised to find that, at the end of the treatment, he had cured his patient of an aneurism of the innominate artery by its becoming solidified. Dr. Balfour, from his researches and experience with this method of treatment, speaks very positive in its favor, and is disposed to rank it as superior to all other remedies, especially in internal aneurisms where surgical appliances cannot be brought to bear upon the disease. The remedy cures by means of coagula formed in the sac, thus solidifying its cavity. He confesses he is at quite a loss to explain the *modus operandi* of the remedy. As he is not disposed to think that iodide of potassium increases the plasticity of the blood, its beneficial effects can only be accounted for in these cases from its probable sedative effects upon the heart and nervous system. The correctness of this theory is somewhat apparent, from the fact that the first effect of the remedy is to relieve the pain, even before there is any perceptible effect produced upon the tumor. In the administration of this remedy, Dr. Balfour recommends that it be given in as large doses as can be tolerated by the patient, and that it should also be continued for a long time—not less than a year—in order to effect any permanent beneficial result, and during this period the patient should be kept perfectly quiet and in the recumbent position, if possible.

Still another method of treating aneurism, upon the principle of compression, has been devised by Mr. George H. Porter, of Ireland, which consists in arresting the circulation in the artery by means of an artery compressor, acting somewhat upon the

principle of acupressure, and yet possessing advantages over both that method and the direct application of the ligature. This little instrument is constructed of small silver or iron wire, about the size of an ordinary probe, bent into a triangular shape, half an inch wide at its base and four inches in length upon its sides, with a small ring fixed at the apex of the triangle, and the base perforated by two small apertures just large enough to admit the passage of a small silver wire. In applying this instrument an incision is first made down to the vessel, around which the wire is carried with an aneurismal needle; the needle is then withdrawn and the two ends of the wire are passed through the openings in the base of the triangle and attached to the ring in its apex, thus exerting any required degree of pressure upon the artery, which is clasped between the wire beneath and the base of the triangle above. If it be true, as has been stated by Dubois, Percy, and Compton, that it is not necessary to cut the inner coats of the artery in order to arrest the circulation sufficiently to occlude an aneurism, we should be disposed to regard this little instrument as admirably adapted for this purpose, as it may be—according to Mr. Porter—held upon the artery for sixty hours without inflicting any injury to its coats, and can be conveniently removed without injuring the vessel, by cutting the wire at its attachment to the ring and withdrawing it from beneath the vessel. By thus preserving the structures of the artery, all danger from secondary hæmorrhage is avoided, which sometimes occurs after the use of the ligature, especially where we are compelled to apply it too near an arterial branch.

In conclusion, from our own experience, we are disposed to rely almost entirely upon compression in the treatment of aneurism, where it is possible to manipulate the vessel by digital compression or apply a tourniquet. Within the past year we have treated two cases by compression with the tourniquet, and secured most satisfactory results.

Case No. 1 was a man aged fifty-two years, who was admitted to hospital on the 11th February, 1870. Upon examination a pulsating tumor was discovered in the left groin a little larger

than a goose egg in diameter, though but slightly elevated above the plane of the abdominal wall, with its lower edge extending to just below Poupart's ligament, the greater diameter being transverse to the axis of the external iliac artery in which it existed. The pulsation was quite distinct, not only to the touch but also to view; and by auscultation the *bruit* could be distinctly heard. The patient also complained of excessive pain at the site of the tumor, so that he could not rest either night or day except under the influence of opiates. The treatment consisted in the application of Erichsen's abdominal tourniquet, with the compress resting upon the abdominal aorta at a point corresponding to the umbilicus, and tightened until the pulsation entirely ceased, both in the tumor and the femoral artery of the opposite side. This degree of pressure—though very painful to the patient—was continued for one hour, when the tourniquet was relaxed and placed at a point lower down, and so adjusted as to allow some blood to flow through the right femoral and admit of slight pulsation in the tumor. This pressure was continued for one hour and thirty-five minutes, when the tourniquet was removed and no pulsation could be observed either in the tumor or the femoral artery below it, and the patient expressed himself as entirely free from pain. As a precautionary measure, when the tourniquet was removed from the abdominal aorta, Dupuytren's tourniquet was lightly applied to the femoral artery on the distal side of the aneurism and allowed to remain ten hours, after which no pain or pulsation was felt in the tumor, and the case was discharged cured, the entire time occupied in compressing the artery being only two hours and thirty-five minutes. It is proper to state here, that during the first hour, while the compression was so complete as to entirely arrest the circulation in the lower extremities, there was no evidence of hyperæmia of the brain, lungs or abdominal viscera, which was probably due to the fact that the vena cava was equally compressed with the artery.

Case No. 2: a man thirty-one years of age, apparently otherwise in good health, was admitted to hospital 21st May, 1870, with an aneurism of the right popliteal artery, measuring four

and a half inches in its transverse and three and a half inches in its longitudinal diameter. Every pulsation of the tumor gave the patient great pain. Being a cooper by occupation, the aneurism was caused from resting his leg—the portion back side of the knee—upon the edge of barrels, as he was compelled to do by his occupation. The aneurism first made its appearance seven weeks before he came to the hospital. The treatment was commenced by applying Dupuytren's tourniquet over the femoral artery, with such a degree of pressure as to almost entirely arrest the pulsation in the tumor. This pressure was kept up continuously for nine and one-half hours, when the tourniquet was removed and the pulsation in the tumor found to be very much diminished. The knee was then placed in the flexed position for ten hours, at the end of which time the pulsation in the tumor was found to be about the same as when the tourniquet was removed. The tourniquet was then reapplied as before and continued for ten and one-half hours, when the pain and pulsation had entirely ceased in the tumor. This patient was readmitted to hospital two months later for heart disease, when he still suffered no pain whatever in the popliteal region, and the cure was certainly permanent. There was one peculiarity, however, in this case, which we had not observed in others before, *i. e.*, the temperature as indicated by the thermometer was on an average two degrees higher in the affected leg than in the sound one—while the œdema, which followed the treatment for several days, was much more marked in the sound limb than in the one affected with the aneurism. The whole time occupied in the treatment of this case was thirty hours, while actual compression was used but twenty hours.

Prof. Paul F. Eve reports one case of popliteal aneurism occurring in a healthy man thirty-eight years of age, who was treated under my observation at the City Hospital last January, in which digital compression of the femoral artery was made by a relay of medical students for the first six hours, when the pressure became so excessively painful that the patient could not endure it longer; then Dupuytren's tourniquet was applied to the artery for twenty-four hours, exerting such a degree of

pressure as to almost completely arrest the pulsation in the tumor. At the end of this time the tourniquet was removed and the aneurism found to have ceased pulsating, and the patient was entirely relieved of pain, from which he had suffered severely before the treatment was commenced. As a precautionary measure the tourniquet was kept lightly applied for forty-eight hours after the pulsation had ceased in the tumor, when the patient was considered cured. Three months later, I saw this case again. He complained of no inconvenience from the aneurism, and the cure is, I think, certainly permanent.

AMPUTATIONS.

In venturing upon the subject of amputations we have, perhaps, nothing to offer that is new, or not generally known to the profession, and shall therefore only notice briefly the discussion of some operations which are not definitely established in practice.

In reviewing the history of this special branch of surgery, we can claim but little advance for it within the past few years. Indeed the light of knowledge in regard to this once most formidable and dreaded of operations, which burst upon it with the introduction of the ligature by Ambrose Paré, in 1560, seemed to be almost perfected by that of the tourniquet by Morrel in 1674. And yet there is probably no operation in surgery that has emerged from such a veil of darkness and dread, as that of amputation.

In looking back through past centuries, with our present knowledge of the safety and simplicity of the operation, we have evidence that surgery like other sciences, has indeed passed under the cloud of the dark ages; a period in which, though great men and philosophers lived, there were none who could devise a means successful to grapple with hæmorrhage. The utter ignorance and cruelty with which amputations were then performed, would seem, under the light of the present day, almost inexcusable. There was a time when the boldest surgeons shrank from the terrors of this operation and refused to

perform it at all, while others would only amputate through gangrenous parts, or even worse, induce gangrene by a preliminary step in the operation—tight ligation of the limb. Others again who were more bold, would sever the limb at a single blow, or with a red hot knife, as was practiced by Hildamus. Scultitis severed the parts upon the same level with a mallet and chisel. Hans de Gorsdoff constructed a guillotine of two butcher's chopping knives fixed into heavy blocks, by which he severed the limb instantly, and then attempted to control the hæmorrhage by tying a hog's bladder upon the face of the stump; others would bind up the stump in the inside of a recently killed chicken, to arrest the hæmorrhage. Others again would plunge the stump into boiling pitch.

It seems at this age no surgeon had thought of covering the bone with a flap from the soft parts until after the introduction of the ligature and tourniquet, when the operation was immediately improved by Chesseldon, who divided and retracted the skin and fascia, and then cut through the muscles and bone. Alanson soon improved upon this operation by making a circular incision, first through the skin and superficial fascia, and then dividing the muscles obliquely upwards and inwards towards the bone, which was sawed through at the bottom of the cone. This, and similar flap operations continued in vogue up to the beginning of the eighteenth century, when Mr. Goudham, of Oxford, instituted the flap operation, which is now generally adopted by all surgeons of experience in amputations, where a sufficient amount of muscular tissue can be procured to form the flaps.

The next step in the progress of amputations, after the mechanism of the operation had become established, was the practical introduction of anæsthesia, by Dr. Horace Wells, of Hartford, Conn., in 1844. The priority of this discovery, we think, from the evidence presented to the United States Senate, by the Hon. Truman Smith, United States Senator from Connecticut, undoubtedly belongs to Dr. Wells, and not to Dr. Morton, the late claimant for that honor.

With the introduction of anæsthetics is associated the period of greatest advance in the progress of all developments in sur-

gery. Since that period operations which were previously considered intricate and formidable, are now simplified and made easy, because of the greater ease and facility in operating, as well as the prevention of shock upon the patient, to say nothing of the moral influence it exerts in controlling the terror and fear of the operation.

As to the rate of mortality following the administration of chloroform—which is the representative of this class of remedies—we regret to say that it has materially increased during the past few years, and that too without any very obvious cause; unless it may be attributed to the impurity of the drug as we find it in the market at the present day. It will doubtless be remembered by every surgeon how rare it was in former years to see a case of death reported from the use of chloroform; while now, they are becoming even common.

During the late war, when chloroform was administered so extensively, and often carelessly, we have not been able to learn of a single fatal result from its use. In our own experience, during the same period, we saw it administered certainly not less than two thousand times without observing a single threatening symptom.

Prof. Gross asserts that he has administered chloroform several thousand times without a single death, and that but two cases excited any alarm and that was from the neglect of his assistants. In Guy's hospital, chloroform was administered twelve thousand times before there was any serious accident. In the Crimean war, it was administered upwards of twenty-five thousand times without a single death.

Certainly the statistics of the present day can show no such favorable results as those mentioned above. Our present increased rate of mortality, we are satisfied, must be a result of the impurity of the chloroform used, though in what this impurity consists is not always known; but it is most likely an excess of fusel oil, which abounds in large quantities in much of the alcohol with which some chloroform is diluted.

As to the advantages of the different methods of amputating, either by circular or flap, the profession seems to stand divided

as formerly, each surgeon followed one or the other for reasons perhaps peculiar to himself. But we believe that a large majority of surgeons favor the flap operation, and we think very justly, too, for many reasons:

First,—The flap operation has the advantage in having more surplus to cover the end of the bone, in case gangrene or sloughing should take place. If after the circular operation any sloughing should occur, the bone is more liable to be left exposed and under such circumstances a much longer time is required for the stump to heal over.

Second,—In the flap operation, the stump is better drained, with no bagging or retention of pus, as occurs in the circular operation.

Third,—The flaps make a better covering for the bone, and do not leave a hardened cicatrix attached to the end of the bone.

Fourth,—A limb amputated by the flap operation is better adapted to the adjustment of an artificial limb. This fact was established by the unanimous concurrence of a Commission, of over a dozen manufacturers, appointed by Surgeon General Hammond, in 1862, who reported that stumps made by the circular operation, were as a general rule, in every respect inferior to such as are made by the flap.*

Again, in attempting the circular operation in amputations of the thigh, where the muscles are large and well developed with a considerable amount of adipose covering, the skin flaps are required to be made so long that not unfrequently the blood vessels are not carried through the skin to the end of the flaps, which necessarily perish for want of sufficient nutrition.

As to the period at which amputations should be performed, after severe injuries rendering the operation necessary, is a question about which there is not so much diversity of opinion as was in former years; it being almost unanimously agreed, especially by American surgeons, that in all cases where the vitality is not too low from previous "shock" or hæmorrhage, amputation

* Gross' Third Ed., Vol. I.

should be performed at once, while the patient is still in the condition of concussion, before reaction is established. We have observed the fact to be especially true of our own experience in the treatment of gunshot injuries requiring amputation, that the patient will react quite as readily from both the original injury and the amputation as from the injury itself, unless the concussion be so great as to threaten the life of the patient immediately, when of course no operative procedure would be justifiable. But there are still those who contend for a delay in operating, amongst whom we may mention Prof. Frank H. Hamilton, who insists that amputation should be delayed in such cases until the period he designates as "primary," by which he means the period intervening between the establishment of reaction and suppuration. But as this gentleman stands so much alone in his views upon this subject, we do not deem it profitable to discuss the question farther.

As to the claims of modern surgery in selecting advantageous sites for amputating, there is but little to concede beyond the established rules of practice. Such advances as have been made in this direction are still questionable as to their merits. In amputations about the ankle joint, it has recently been claimed by some English surgeons, amongst whom are Mr. Hancock, Mr. Morgan, Mr. Mayor, and Mr. Gay, that, where it is possible to do so, the bones should be sawn through, and under no circumstance disarticulated where it can be possibly avoided; and especially where the disease exists in the anterior row of tarsal bones, that by preserving the articulation between this and the first row, so much of the arch of the foot is preserved as to render it an object to save this articulation. But as neither of these gentlemen have reported a sufficient number of successful cases to establish this operation as a rule of practice, we are not disposed to accredit it with advantages in all cases requiring amputation at the ankle joint. While we admit that it may not be so objectionable in certain cases of recent injury to the bones of the tarsus, we could not be induced to practice the operation in case of extensive disease of the joint, from the well known fact that these bones are all made up of a cancellated structure,

on account of which there would be much more liability of pyæmia by sawing them through, than by disarticulating them. And again, it is almost invariably true of all diseases of the ankle joint that the synovial membranes and cartilages are the first involved, or, if not the first diseased they soon become so where they are in contact with the diseased bone. In view, then, of these facts, we think it a more rational practice to remove these offending articular structures with the bones by separating them at the articulation, and thus avoid the greater liability of pyæmia and the almost certain danger of caries or necrosis extending into the remaining fragments of the bones, as is likely to occur under all circumstances where these bones are disturbed in their continuity and their nutrition interfered with. Probably the most rational exception to this operation is Lisfranc's improved Hayes' operation, which consists in sawing through the base of the metatarsal bones instead of disarticulating. But even this is objectionable in cases where the structures of the articulation are involved in disease. But in recent injuries this operation is much preferable to disarticulation of the metatarsal bones, from the comparative ease with which it is performed; besides it preserves the insertion of the tibialis anticus muscle which counteracts the tendo Achillis to such a degree as to maintain the proper angle of the foot with the leg. With the exception of this operation as improved by Mr. Lisfranc, we are not favorably disposed towards any of the popular operations about the ankle joint where the os calsis is left intact, or any part of it connected with the tendo-Achillis, from the great extension which takes place at the ankle joint forcing the remaining portion of the foot into a line with the axis of the leg, thus impairing the use of the limb to a greater extent than amputation at the ankle joint would do. Even Pirogoff's operation is objectionable, from the great tendency of the remaining fragment of the os calsis to become necrosed, besides a still more serious danger of the pus burrowing up under the sheath of the tendons and exciting an erysipelatous inflammation throughout the entire limb. This danger was always dreaded very much by Mr. Pirogoff, and it is asserted by many that, before his death,

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he abandoned the operation himself, probably for this reason, and the frequent occurrence of necrosis in the remaining fragment of the os calsis.

The question of amputating at the knee joint is one which is not definitely settled in the minds of all surgeons, notwithstanding the operation dates back to an early period in surgery, and after the introduction of the ligature fell into comparative disuse until about 1830, when Mr. Velpeau made an attempt to revive it by a report of several successful cases operated upon by himself. But the effort seemed to be ineffectual in rendering the operation popular, until Prof. Nathan Smith, of Baltimore, Mr. Lane of London, and others, a few years since adopted the operation, since which time it has become more popular, and at the present day is spoken of favorably by many of our leading surgeons. Mr. Erichson speaks of the operation in very favorable terms. Mr. Syme has also adopted, and as he thinks, improved upon the operation by sawing through the condyles. Prof. Gross says that the great success which has attended this operation, both in this country and in Europe, renders it extremely probable that it will soon come into general use.

Surgeon General Barnes, in Circular No. 6, S. G. O., in speaking of this operation, states that it has found numerous advocates during the War, and has been frequently performed. His returns to October, 1864, give 132 cases, of which 52 recovered and 64 died; in six cases re-amputation of the thigh was subsequently performed, with three deaths and three recoveries, and in ten cases the result was still undetermined. This result he thinks quite encouraging, and he says "when we look at the figures of primary operations alone, it is still more gratifying. Of forty-nine cases of primary amputations, thirty-one recovered and sixteen died; two underwent re-amputation, one living, the other, a tuberculous subject, died."

This gives a percentage of mortality in primary operations at the knee joint of 34.9, which is very much less than at any point above. Considering the disadvantages under which these patients were placed, the results are certainly better than could have been expected.

Dr. Markoe, of New York,* gives the result of forty-six cases of amputation at the knee joint, showing a mortality of 37 per cent., which is 7 per cent. less than at any point in the contiguity of the femur.

Dr. Brinton, of Philadelphia,† reports that the whole number of recorded cases of amputation at the knee joint during the late War, was two hundred and eleven. Of these, ninety-six recovered, and one hundred and six died, while the results in nine were undetermined. Re-amputation of the thigh was resorted to in twelve cases, in nine successfully, and in three fatally. The average mortality of the whole number is thus 50.2. The mortality of thigh amputations performed during the same period was 64.43 per cent. Dr. Brinton also reports a collection of sixty-four cases occurring in American civil practice, with a mortality of twenty-eight per cent., and in European practice, 27.65 per cent., while the mortality for thigh amputations is in America about 41.4 per cent., in Paris 62.2 per cent., and in Great Britain from 50 to 70 per cent. Dr. Brinton attributes the advantages of this operation to the diminished shock to the system, the small extent of suppurating surface, and to the fact that the shaft of the femur is not sawn across, thus avoiding the danger of pyæmia and osteo-myelitis.

There is still a difference of opinion amongst surgeons who advocate amputating at the knee joint, as to the best method of operating. It has been asserted by Mr. Syme—and indeed claimed by him as an improvement—that to operate by sawing through the condyles of the femur, (the same operation is also advocated in Langenbeck's Archives under the name of trans-condylic amputation of the femur), there is less suppuration than where the operation by disarticulation is performed, and consequently a better hope of union by the first intention in the flaps, it being asserted that if such union does not occur the flaps will retract to such a distance that the final union will form a large, sensitive cicatrice, which would be disadvantageous in ad-

* N. Y. Jour. of Med. and Surg., Jan., 1856.

† British Med. Journal, August, 1868.

justing an artificial limb. The operation by exarticulation has been advocated by Messrs. Lane, Ferguson and Coulson, for the reason that it is less liable to produce pyæmia than sawing through the cancellated structure of the condyles. The danger from synovitis which is often mentioned as an objection to exarticulation, Dr. Brinton states, is all imaginary and should not influence the surgeon in deciding upon this operation.

As to the relative merits of the two operations, i.e. amputation at the knee joint, or in the shaft of the femur, we think the advantages decidedly in favor of the former, though we admit that the cases are very rare in which amputation at the joint is necessary, or where it cannot be performed higher or lower down, which latter, of course, is the more preferable. But the statistics we have already given, showing a diminished mortality of seven per cent. in favor of amputations at the joint, is alone sufficient to warrant us in adopting the operation in preference to any point above, while the greater length of stump with the additional muscular attachment preserved by this operation leave a much more useful limb and better adapted to the adjustment of any artificial appliance. But greater than all this is the advantage to be gained in avoiding the section of the shaft of the bone and exposing the medullary canal, which is not unfrequently followed by osteo-myelitis and pyæmia, a result not possible so far as the bone is concerned in exarticulation at the knee-joint.

As regards amputations at the hip joint no recent improvements have been suggested, except that of arresting hæmorrhage during the operation by compressing the abdominal aorta, which relieves this very formidable operation of its chief embarrassment to the operator. Prof. Lister, of Glasgow, has invented a very excellent apparatus for this purpose. (See Bell's Manual of Surgical Operations.)

ACUPRESSURE AND TORSION.

Acupressure and torsion—the latter of which ranks amongst the early methods of arresting hæmorrhage—were some years since revived by Amussat, and after a brief period of popularity

in France, again fell into comparative disuse, until more recently again revived by British and German surgeons, some of whom advocate the superiority of these hæmostatics with a zeal only equaled by their apparent determination to have them supersede the ligature, which, although claimed, by such, to be inferior to acupressure and torsion, because of the greater delay in the healing process, consequent to the amount of suppuration excited by the presence of the ligature in the wound, must be conceded, even by the strongest advocates of other methods, to be at least a safe and reliable means of controlling hæmorrhage. Of those who favor acupressure and torsion, in preference to the ligature, there seems to be a decided expression in favor of torsion, except under certain conditions where the mouth of the vessel cannot be reached, and torsion is of course impossible, when acupressure must be resorted to as a necessity. Some German surgeons, however, prefer acupressure for the reason that it does not sever the inner tunics of the artery, but excites a plastic exudation with organic new formations which more surely occlude the vessel, the inner coats of which, remaining intact, have the effect of strengthening instead of weakening it, as in the case of the ligature or torsion where these coats are severed. But of this we shall speak more in detail at the conclusion of this subject.

As to the method of applying torsion, all surgeons, who have practised it, seem to agree that the vessel should be fully exposed and isolated from the surrounding tissues; that it should be seized by wide, grooved forceps and should be twisted from four to six turns of the forceps (where it is not desired to sever the portion of the artery clasped within the forceps); though on this point English surgeons differ widely, some contending that the artery should be twisted until the end of the vessel is entirely severed. But of this we shall speak more fully hereafter.

Then, again, there are those who advocate both "free" and "limited" torsion. In the former method the end of the artery is seized and twisted to the extent desired without any limitation; while in "limited" torsion, the vessel is seized as in the first instance, and with a second pair of forceps is clasped about

three-fourths of an inch from the end, and held firmly so as to limit the twisting to this portion of it. The manner of applying acupressure has not been materially modified since its early introduction into practice. The needle is applied beneath the artery either near its end, or in its continuity, and is fastened either by a wire or common ligature.

Dr. G. M. Humphry, surgeon to Addenbrook's Hospital, strongly advocates the efficacy of torsion in arresting hæmorrhage, but states that the principle is exactly the same as the ligature—that the mouth of the vessel is occluded by the cut ends of the inner and middle coats curling in, and forming a sort of valve—though this gentleman had only practised the method for a few months before publishing his paper, and then only upon medium sized arteries. He considers its application to the large vessels of doubtful propriety. Acupressure, he considers but a slight improvement upon the ligature, if indeed it can be considered an improvement at all.

Mr. J. Cooper Forster, of Guy's Hospital, also seems to have become quite skeptical as to the good results to be expected from acupressure as a means of arresting hæmorrhage. In a more recent paper, Mr. Forster reports nine cases in which he used it with a result of four deaths. One case proved fatal from secondary hæmorrhage, one from pyæmia, one from secondary hæmorrhage and pyæmia combined, and one from pleuro pneumonia following gangrene of the stump. He sums up the result of his experience by the expression that “out of forty cases, one or two at least might have afforded me a happy result.”

Though, while this gentleman is disposed to denounce acupressure, he is still a strong advocate for torsion and quite ignores the ligature; but he does not seem to offer any good reason for dispensing with the ligature and resorting to torsion.

Dr. Henry Lee seems to be much infatuated with torsion, and says it is more applicable to large vessels than small ones, because they are more easily isolated from the surrounding structures, and their internal coats are consequently more easily lacerated. The very inconsistency of this expression, coming from a man whose opportunities have been such as to teach him better, is a fair

indication that his practice in this particular has been prompted more by his prejudice than his judgement; as indeed may be the case with many others who so zealously advocate the claims of acupressure and torsion over the old and well tried method of arresting hæmorrhage by the ligature.

Prof. Simpson, who has so boldly advocated the advantages of acupressure over the ligature, because of the greater amount of suppuration induced by the presence of the latter in the wound, does not seem to find it infallible in every case, as one would be led to infer from the spirited enthusiasm with which he writes upon the subject. Dr. G. W. Callender, Assistant Surgeon to St. Bartholomew's Hospital, in speaking of Prof. Simpson's success with acupressure, says "that he resorted to it in the case of a breast that had been removed at the Hôtel Dieu. Eight needles were employed and there was no hæmorrhage after their removal, but the edges of the wound became erysipelatous, rigors followed and the patient died five days after the operation." This was an instance in which erysipelas was doubtless excited from the presence of the needles in the wound, which are certainly much more irritating when in a closed up wound than ligatures would be for the same length of time.

Dr. Callender, in speaking of his own experience, states "that he amputated the breast of an aged woman for scirrhus; the bleeding was stopped by means of four needles, which were removed thirty-six hours after the operation; but the wound presented an erysipelatous blush, with some dusky discoloration, and, beginning rapidly to distend with products of decomposition, had to be speedily opened. Its entire surface was in a state of gangrene, and the woman, sinking with symptoms of blood poisoning, died six days after the operation. In this case the doctor states that the wound, which was of some size, had been closed, contrary to his usual practice, in the hope that speedy union might be obtained, owing to the presumed absence, through the use of the needles, of all local irritation. Failing in this, the patient was poisoned from the rapid disorganization which ensued and the absorption of the decomposing materials."

Dr. Callender states further, as the result of his observations, that "there cannot be any doubt, and the fact has long been admitted, as to the efficiency of a compress, such as the acupressure needle, to arrest bleeding, but the practical question which remains to be dealt with, is the superiority of this plan of treatment over that of the ligature in favoring early union of wounds, and it is with reference to this point that the two cases referred to are of some interest * * * so far as showing that in the repair of wounds, acupressure has its unfavorable results. Unless the experience of more numerous observations teaches us that the after-process of surgical operations is helped by the use of needles, they must be regarded as but clumsy substitutes for the ordinary ligature.

"The influence of ligatures to hurt the healing of wounds has been of late years unfairly stated. It seems to me, for example, at least doubtful pathology on the part of the more earnest advocates of acupressure, to compare the parts surrounded by ligatures to so many sloughs."

As a substitute for both acupressure and the ligature, Dr. Nathan R. Smith, of Baltimore, has devised an apparatus which he thinks ought to supersede these remedies for reasons made apparent in its very application. This little apparatus consists of a small silver tube, with a double slit at one end, and a fine annealed iron wire passed double through the tube and projecting a loop at the other extremity. In applying it, the loop of wire is laid over the bleeding artery, and the operator now, holding the tube with his fingers or forceps, seizes the free ends of the wire, and draws them steadily until the artery is tightly seized by the wire loop. He now bends the double wire down into the fissure or slit in the margin of the tube, and then gives it one turn around the end of the tube so as to make it secure. When the ligature has accomplished its purpose, the wire is disengaged from the slit and steadily drawn through the canal of the tube severing the end of the artery as with an *écraseur*.

Dr. Smith states that the wire may be removed from arteries of the fourth and fifth magnitude in six hours with safety, and that he has removed it from the femoral artery on the second

day, and no hæmorrhage followed. Dr. Smith considers that this method possesses all the advantages of the ordinary ligature—inasmuch as it affects the vessel in the same way, yet has the additional advantage, that it can be readily removed when it has accomplished the occlusion of the vessel. Besides, he attaches much importance in the process to the electrical condition existing between the tube and the wire, which he thinks has much to do with expediting the formation of the clot in the vessel. Whatever influence may be exerted in this way to secure the occlusion of the vessel, we are not prepared to say, though we imagine it to be rather slight and should not be disposed to attach much importance to it. But, while we have never resorted to the method, it is undoubtedly an ingenious invention and we think superior to any other method of acupressure where the vessel is favorably located for its application, as in a stump or open wound, where the artery is well exposed. It creates less disturbance and irritation in the wound in the process of its removal, than occurs in removing the needles, where acupressure has been practiced, while the amount of force that can be exerted upon the wire after it is adjusted upon the vessel insures the severing of the inner and middle coats of the artery, which is not the case where acupressure is resorted to.

As a safe and sure method of arresting hæmorrhage it is certainly superior to torsion, which we regard as exceedingly unsafe in any vessel that would be likely to bleed without it. However, we do not doubt but that it has been successful in many cases where even the vessels were of large size, yet, it may be a question whether the surgeon is justifiable in risking the life of his patient for all the advantages to be gained, even though it should terminate successfully, for we do know that in many instances, when properly applied, it actually fails to arrest the hæmorrhage, even in small sized arteries, while again there are many instances in which it only arrests the hæmorrhage temporarily, long enough perhaps to allow the surgeon time to return to his office, and before he can be summoned again and reach his patient the consequence is fatal.

Without any spirit of arrogance or inclination to retard the

enthusiasm of gentlemen who apply torsion so fearlessly to the open mouth of the femoral artery, we question much their willingness to risk the application being made to their own femoral or carotid. Such is human nature the world over. Zealous, ambitious men whose enthusiasm blinds their judgments and prompts their prejudices to the distortion of facts, may, urged on by a strong will and desire to accomplish some good for their patients—and perhaps reputation for themselves—innocently perpetrate errors and innovations upon the truth without discerning their own inconsistency; having developed all that is true in a subject, their enthusiasm bounds beyond the limit even of their own dispassionate judgment. But it is to the enthusiasm of such men that we owe most that is true in the development of science; though it is no less true that many of the principles thus formed are found sadly defective, when brought to bear upon practical subjects.

In reviewing the evidence brought to bear in favor of torsion it should be remembered that only the most favorable cases are published, while the cases of failure—which doubtless are much more numerous—are seldom exposed to the world, unless by individuals likely to be more disinterested than the operator himself.

In my own practice in the hospital, during the past two years, I have resorted to torsion in a great many cases—more perhaps than I have seen reported of favorable results by any single individual—and I must say that I have never found it to arrest the hæmorrhage in a single instance, from a vessel large enough to have bled to any extent without it; while indeed, notwithstanding, I observed every precaution to manipulate the artery as directed by those who have operated most successfully, it was but seldom that I was successful in arresting hæmorrhage from the smaller vessels sooner than it would have stopped had I let them alone. I admit that in some cases I may have erred in the manner of procedure, yet this could hardly be true of all the plainer and more simple cases that fell into my hands.

With the exception of the insecurity of the method, I am willing to admit that it does possess advantages over the ligature,

or the method devised by Dr. Smith, yet this one objection is sufficient to cause every surgeon to hesitate in resorting to it, especially in the case of large or even medium sized arteries. It is doubtless true that a stump will heal more readily where the vessels have been treated successfully by torsion, than in cases where the ligature has been used, yet it is not the rule by any means that union by the first intention is secured in such cases, for the reason there must always be a portion of the end of the artery destroyed by the process of compression and twisting, just as occurs in the case of the ligature, and the length of time required to remove this dead portion of the artery by suppuration, we think would be likely to interfere with immediate union in the entire stump.

However, it is the insecurity of torsion, and the fatality following the practice of it, that induces us to reject it when we have other more secure means at hand which will insure quite as good results as when torsion is practiced successfully. Should the vessels be found diseased—as is not unfrequently the case in the human subject—we should regard torsion as wholly inadmissible, and almost certain to be followed by secondary hæmorrhage, even though it should close the mouth of the vessel at the time. Then, considering that there is as much of the end of the artery cast off by suppuration where torsion is used, as when the ligature is resorted to, we cannot determine in what particular the latter method is so much inferior, except that it may be the slight amount of irritation created by the mere presence of the ligature in the wound, which, however, is so trifling that we would scarcely be warranted in exchanging it for the risk of secondary hæmorrhage following torsion.

An unfavorable indication in the history of torsion is the fact that after it was revived by Amussat and so eagerly adopted by Dupuytren, Majendie and Boyer for a short time, it was as suddenly abandoned by all French surgeons, though for what reason is not well known; but had it been as successful in the hands of these gentlemen—whose ability to apply it properly cannot be doubted—as is reported by English surgeons of the present day, certainly it would never have fallen into disuse.

Then again, there are such marked discrepancies in the statements of English surgeons, who advocate the use of torsion most zealously, that this alone would be likely to shake the confidence of the inexperienced in the operation altogether. For instance, Mr. Bryant, assistant surgeon to Guy's Hospital, says, that "in no case is it prudent to twist the vessel till the end is twisted off; for by so doing we do away with the chief safeguard against bleeding; we run the risk of breaking up the valvular incurvation of the inner tunics, and disturb the clot which forms between the retracted ends of the two inner tunics and the twisted cellular coat. * * * It is probably due to this error of twisting off the ends of the vessels, that the practice of torsion has failed to hold its ground."

On the other hand, Mr. Gillespie, surgeon to the Royal Infirmary, of Edinburgh, who has also experimented extensively with torsion, says "that in performing the operation, the point of the artery must alone be seized, and it must be slowly twisted, till the portion included in the forceps comes away. If this is not done, and as I have repeatedly seen, the teeth of the forceps, after twisting for a little, are unclasped, the artery is sure to unroll itself again and bleed more fiercely than ever."

Dr. G. M. Humphry, surgeon to the Addenbrook's Hospital, Cambridge, states that "he rotates the forceps till they are free, the piece of vessel included in them being twisted off." Now, since these gentlemen, who have perhaps experimented more than any others, differ so widely in their methods of operating, each declaring that his method is a *sine qua non* to success, and that that of the other must of necessity fail for reasons apparent to him, and has repeatedly failed in his hands, how can we do otherwise than distrust the safety of torsion, when applied to vessels of any considerable size, or indeed, whether it can be relied upon to arrest hæmorrhage from an artery of any size, where surgical interference would be at all required?

As to the relative merits of acupressure and torsion, compared to the ligature, as viewed by German surgeons, we give the following translation from "Langenbeck's Archives," for which we are indebted to Dr. H. Z. Gill, of this city:

From experiments it follows "that in order to the occurrence of coagulation within a certain brief period—in this is the most important point clinically—it is necessary that there exist or occur an injury of the inner coats of the artery, together with a coagulation of the blood at the injured point.

"The injury of the inner coats, if it is not a *sine qui non* to the formation of the thrombus, is still for its early occurrence indispensable.

"According to these two observations we must confirm the assertion of the English, namely: That in acupuncture and acupressure a direct injury or rupture of the inner coats, as we observe in ligature, does not take place, so far as this can be observed with the naked eye aided by a lens.

"Therein consists an important difference opposed to the ligature. But still microscopic examination must decide whether or not very small injuries to the coats are present.

"On the other hand, O. Weber may be right in asserting that the needle cuts in much sooner than the ligature, and occasions quickly a mortification of the compressed tissue; especially is this the case when a ligature is also placed around the needle. This is a well known fact. This, however, can only be of importance in hæmostosis, when it is proven that for this purpose—the safe arrest of hæmorrhage—a very strong pressure of the needle is necessary, so much so, that in the short time till the safe removal of the needle an incising of the coats must take place."

From another series of experiments the following is drawn: "From the last investigation the very important fact exhibits itself, namely: that the needle, without the least incision or occasioning mortification of the tissue, can produce a perfect closure of the vessel by coagulation.

"When this is the case in acupuncture in the continuity, we should suppose, *à priori*, that it would occur so much the more in the case of the end of a divided vessel. Thus far the views of the English are corroborated.

"By the last two experiments is the observation confirmed, that at the place where the acupuncture needle pressed, once, small

longitudinal fissures of the inner coats occurred, single or more of limited extent.

“Through these fissures is organic union formed between the thrombus and the wall of the vessel, by the passage over of vessels embedded in the lines of connective tissue. A farther change at the acupressed point consisted in thickening of the vessel wall by bundles of connective tissue of new formation in the middle coat and towards the outer coat.

“In two examinations the thrombus continued unbroken from the proximal or cardiac part of the vessel into the peripheral part; while in the first of these two, only a contraction of the calibre by thickening of the walls and thereby a narrowing of the thrombus corresponding to the acupressed point occurred. These acupressure experiments prove that to the thrombus is ascribed the chief part in the definite closure of the vessel, yet the proof is still wanting that acupressure and acutorsion on a divided end have a greater importance for the present practice.”

Three cases after amputation. “We come, therefore, to the conclusion, that in acupressure and acutorsion in reference to the needle on the wall of the vessel is perfectly analogous, to wit: the occurrence of folds and the thickening of the middle and outer coats, and that in consequence of the textural changes of the wall, the vessel will retain the same form after the removal as during its presence. Also in acupressure, we find the point where the needle had pressed the walls against each other, at a later period, permeable, but the calibre filled up by thrombus.

“Numerous observations and experience must decide whether acutorsion in reference to rapidity and certainty in hæmostasis deserves the preference over acupressure, or *vice versa*.

“Why may we not expect a temporary arrest of hæmorrhage in ligation when the thread is removed after the same length of time as the needle? The thread acts much more locally than the needle, which latter, as well in acupressure as in acutorsion occasions to a definite extent, a slight rupture of the wall of the vessel, so that it gives rise to a wider extended inflammatory swelling. But more essential is the circumstance, that in ligation at

the point where the wall of the vessel, for the temporary arrest of hæmorrhage, should offer the most resistance to the pressure of the blood, not only are the middle and inner coats cut through and retracted, but also the external coat is so strangulated that inflammatory swelling of it is impossible, but on the contrary gangrenous mortification is the rule. The vessel wall can therefore play no active part in the hæmostosis, but this is only secured when the thrombus has formed an intimate union with the vessel-wall. That it is the thrombus which prevents hæmorrhage up to the time of the falling off of the ligature arises from various circumstances.

“One may easily convince himself on ligated arteries of any considerable size, that the divided middle and internal coats do not so far roll in as to come in contact, but that a portion of the calibre between them remains. For this reason a direct union of the internal and middle tunics is impossible, if it were not improbable, according to analogy, from the non-vascular condition of the inner coat.

“Thus are we led by our investigations to establish again in its right, the doctrine of Petit, according to which the inner coagulum presents the chief factor of permanent hæmostosis.

“We must hail the introduction of the Simpsonian method of arresting hæmorrhage, as an advance which justly attempts to remove the ligature out of its old position.

“In diseased arteries acupressure has the preference over acutorsion on account of injuring the vessel less.”

Here we meet still another contradiction growing out of the experience of German surgeons, as to the pathological conditions necessary to ensure the complete closure of the vessel by any of these methods, one party denouncing torsion, another the ligature, while others again advocate acupressure and torsion almost indiscriminately, all of which must of necessity confuse the dispassionate observer and really increase our confidence in the ligature, which has stood the test for so many years, and which so few surgeons have ever had cause to regret using. However, farther experience in that direction may divest the ligature of its disadvantages, or develop a method as

secure in its results; until then we shall be content with the ligature for the safety it has guaranteed us in times past.

PERCUTANEOUS LIGATION.

Percutaneous Ligation of arteries, first mentioned by Ledran as early as about 1720, and since described, first, by Prof. Middeldorpf, of Breslau, in 1856, consists in throwing a ligature beneath the vessel, either in its continuity or near its cut extremity, by means of a curved needle, varied in its length in accordance with the depth of the artery to be reached, and armed with a wire or common ligature. The integument is pierced by the needle, which is carried beneath and around the vessel to a point of exit through the skin at an equal distance from the vessel on the opposite side, including at the same time a considerable portion of the soft parts, especially around the deeper seated vessels. The ligature, thus carried around, is tied on the skin over a compress of lint or a light roll of adhesive plaster, with just sufficient degree of tension to arrest the circulation in the vessel. The needles used for this purpose are curved according as the artery is situated deep or superficial, and without being sharp on the edges, are very pointed and rather flexible. They may be introduced either by needle-forceps, or, made with an eye near the point, may be provided with a handle which can be detached at will. The thread or wire must be strong and not too small, in order that it may not break in tying, or cut too sharply into the soft parts. The entrance of the needle should be made from one-third ($\frac{1}{3}$) to one and one-half ($1\frac{1}{2}$) inches from the artery.

When the artery is once secured, the after treatment is very simple. It may be allowed to remain a short time until coagulation has taken place, or—especially if it be a wire ligature—it may be allowed to remain six or eight days without causing any injury to the nerves or developing an excessive inflammation in other parts.

The manner of applying this remedy as we have briefly described from the translation of Prof. Middeldorpf's paper by Dr.

Gill,* is certainly very simple and ought to be safe even in the hands of an inexperienced operator; while its application in certain cases ought to place it in the front rank of hæmostatics, for the very reason that it can be resorted to in cases where neither the ligature, torsion, acupressure nor styptics can be made available, especially in certain cases of hæmorrhage from the deep branches given off from the arches and the interosseous arteries, where, as Prof. Middeldorpf says, the part may be sewed through and through. This procedure can be resorted to readily in wounds about the hands and feet.

However, we should regard this method as more applicable to the superficial vessels, as those of the head and face, radial and ulnar, anterior and post-tibial, the palmar and plantar arches with their branches. It is well adapted, according to Prof. Middeldorpf, for the treatment of superficial anastomatic aneurisms, including nevi occurring on any part of the body. We think this remedy less applicable to the deeper vessels, from the greater difficulty in passing the needle beneath them, as well as the great amount of other tissue that would necessarily be involved in the ligature, which might, in some cases, prevent the arrest of hæmorrhage from the vessel, or if sufficient force be exerted upon the ligature to control the hæmorrhage, cause too much strangulation in the tissues surrounding the artery. Prof. M., however, has applied it in such cases with very satisfactory results, and assures us that there is no danger to be feared from the compression of the nerves, as there is sufficient cushion of other tissues within the ligature to protect the nerves against injury from any degree of pressure necessary to arrest the hæmorrhage.

This method we should judge peculiarly applicable to wounds of the plantar and palmar arches, from which, from the fact of the extensive anastomoses about these parts, hæmorrhage is often so difficult to control by all other ordinary means at the command of the surgeon; even ligation of the radial and ulnar arteries not unfrequently failing to arrest the hæmorrhage. The

* Medical Archives, Dec., 1869.

same is true of the wounds of the plantar arteries (ligation of the anterior and posterior tibials will sometimes fail to check the bleeding), and in both instances it not unfrequently occurs, that if some time has elapsed after the wound has been received and the parts much swollen, it is almost, or quite impossible to secure the end of the vessel with the ligature, or to apply torsion; and if there be much swelling the acupuncture needle would be objectionable from its tendency, if applied near the wound, to cut through the skin and bury itself in the tissues beneath. In such cases we should be very much disposed to resort to the percutaneous ligation, though it is *only* in such cases that we should feel disposed to apply this remedy. Certainly in no instance where the vessel could be secured in the wound by a ligature, would we resort to it.

Prof. Middeldorpf, in a preliminary paper on this subject, reports ten cases in which he resorted to it successfully in every instance. In these cases he applied it once to the occipital artery, three times to the palmar arches, twice to the plantar arteries, twice to the temporal artery—in one of these cases for anastomatic aneurism of the orbit—in which he also compressed the supraorbital artery. In another instance he applied it in the case of anastomatic aneurism of the upper lip by transfixing the sutures through the lip, which was successful in arresting the pulsation on one side.

As to its *modus operandi*, this method possesses no advantages over acupuncture, and is only more admissible in cases where that remedy cannot be applied, as in arteries deeper seated than could be compressed by the acupuncture needle.

POSITION.

Too much cannot be said in urging the advantages of position as a means of controlling hæmorrhage. It is a remedy so easy of application, so simple, and so perfectly natural, that even those not educated, instinctively resort to it as a palliative remedy, which in many cases is alone sufficient to control a considerable arterial hæmorrhage; and by the surgeon, it must ever

be regarded as a valuable adjuvant in every case where it can be practised. But it is a remedy so old, so common and so familiar to every surgeon that but for the place it occupies in the catalogue of hæmostatics, it would seem almost superfluous to mention it in this paper.

But having referred to the subject, we desire to call attention more particularly to *flexion of the joints* as a means of arresting hæmorrhage in the extremities, in cases where other remedies cannot be applied conveniently, or as a temporary resort until more radical appliances can be used. This simple, but efficient remedy is too often overlooked or forgotten by surgeons when at least temporarily, it would serve them best, and in many cases, especially when combined with elevation of the limb, and the additional advantage thus of gravitation operating against the force of the heart's action, if persevered in would be found sufficient to permanently control it.

Hæmorrhages from injuries of the arteries of the leg and foot and fore arm and hand, may often be controlled permanently by firmly flexing the knee or elbow joints. Certainly the remedy would be a valuable adjuvant in cases where torsion was resorted to with a view to a permanent cure.

An objection, however, to flexion, if it be used with much force, is the inability of the patient to endure it for any considerable length of time, on account of the great amount of pain it causes; but when possible to combine with its elevation of the limb, it may be practiced at such a moderate degree as to be tolerated and at the same time made efficient.

Of the *styptics* most to be relied upon as hæmostatics, we have found nothing equal to the undiluted liquid persulphate of iron, and as a rule, when it fails in our hands we accept it as an indication to resort to mechanical means at once.

ANTISEPTIC TREATMENT IN SURGERY.

The treatment of wounds on the antiseptic system has of late attracted such a degree of attention that, if all that has been written of it be true, we cannot but accept it as a very material

advance in surgery. The objects to be gained by this system are to secure union by the first intention where the nature of the wound is such as to render it possible; to prevent suppuration in wounds by destroying the germinal elements of decomposition both in the atmosphere and the wound itself, and at the same time prevent the occurrence of septicæmia in cases where that condition might be developed without such preventive measures.

Although the use of antiseptics in the treatment of wounds is by no means a modern discovery, their more general use and improved methods of application may be said to be of recent date.

Their extensive application at the present day has doubtless grown out of the recently discovered antiseptic properties of carbolic acid, which, by the persevering efforts of Prof. Lister, has become a common remedy in the hands of almost every surgeon. Notwithstanding there may be other remedies of a similar character which would meet the indications equally well, the carbolic acid, as popularized by Mr. Lister, has become fashionable, and it will probably have to pass through its epidemic period, and its specific virtues be better defined, before the indications for its use will be fully established, and other similar remedies receive the attention their merits may entitle them to.

To Prof. Lister is due the credit of developing most that is known of the medicinal properties of carbolic acid, as also the best methods of preparing the remedy for practical use, a matter certainly not well understood by every one who uses it. If we may judge from the irregular, promiscuous manner in which it is used by many surgeons, it would seem that the real object for which it was intended by Mr. Lister is not generally comprehended. For example, in the treatment of recent wounds where immediate union is desired, we not unfrequently see the carbolic acid applied directly to the wound day after day, until, as might be expected, the surface of the wound is stimulated to granulation and consequently suppuration—the very condition of things which was intended to be avoided—thus preventing what might have resulted in union by first intention had the wound been left to nature. It is probable that where the car-

bolic acid, or indeed any other antiseptic, promotes union by the first intention, it is when it is applied to the wound immediately and but a single time, and in such a degree of dilution as not to cauterize the tissues. In this way the remedy is absorbed before a sufficient inflammatory action can be established to produce granulation. While if the application be frequently repeated, and especially if the solution be concentrated, the tissues become stimulated to granulation and suppuration.

Another important part performed by the carbolic acid dressing, according to Mr. Lister, is that it destroys the fomites or germs floating in the air, which, when allowed to come in contact with an open wound, immediately excite a condition of fermentation, disintegration and suppuration which materially retards and prolongs the process of healing. To avoid this evil and keep the atmosphere about the wound in a state of purity, by destroying these germinal elements, he has, after numerous experiments, devised a plaster of carbolic acid, which he spreads upon a cloth and applies to the wound, as a protector and outer dressing, avoiding always to allow the acid to come in contact with the wound. His formula for preparing the plaster is as follows: * Take of shell-lac three parts, crystallized carbolic acid one part. Heat the shell-lac with about a third of the carbolic acid over a slow fire till the lac is completely melted; then remove from the fire and add the remainder of the acid and stir briskly till the ingredients are thoroughly mixed. Strain through muslin and when the liquid has thickened sufficiently, by cooling, spread it upon cloth about one-fifth of an inch in thickness. Afterwards brush the surface of the plaster with a solution of gutta percha in about thirty parts of bisulphide of carbon to prevent it sticking. This latter application, however, should only be made to the plaster in cases that require frequent dressing, and in which it is not desirable that the plaster should stick to the skin. But where it is desired to apply the dressing permanently, as in compound fractures, the surface of the plaster should not be painted with the gutta percha solution, in order that it may adhere to the skin.

* British Medical Journal, November, 1868.

In applying this plaster to wounds requiring either frequent or permanent dressing, the wound, after a direct application of the acid immediately or soon after the receipt of it, should be protected by the interposition of two or three folds of cloth between it and the plaster, to prevent the acid in the plaster coming in contact with the wound, or what Prof. Lister considers much better, a piece of tin foil, which cannot be penetrated by the acid, the sole purpose of which in the dressing is to disinfect the atmosphere about the wound.

After a long series of experiments, extending through many years, Mr. Lister has finally settled upon this plan of antiseptic treatment in wounds, which has been almost universally adopted by the profession, both in this country and in Europe. Yet, although surgeons have so generally adopted the use of carbolic acid as an antiseptic dressing, this does not, we think, necessarily imply that it is so far superior to other remedies of its class.

Indeed we have never been able to distinguish any material difference between the medical properties of carbolic acid and creosote, they being almost identical in their chemical composition, and derived from the same organic substance, and their effect upon the tissues of the body, when applied locally, seem to be the same, so far as we are able to determine by the physical symptoms produced.

The chloride of zinc also is entitled to much credit as a rival antiseptic — doubtless producing beneficial results in the same way; if systematically applied, it will, in many cases, if not in all, accomplish results equally as favorable, as has been the case in instances where it has been applied after Mr. Lister's method of dressing with carbolic acid. Mr. Campbell de Morgan has reported one case* of compound fracture of the cranium, in which he applied chloride of zinc dressing as directed for carbolic acid, and upon removing the dressing on the sixth day found the wound cicatrized without the production of a single drop of pus. The same gentleman also reports another case in which he made a single application of the zinc after amputating

*Braithwaite's Retrospect, January, 1869.

a cancerous breast; the wound healed very rapidly, and during the period of its healing there was an entire absence of animal odor in the wound.

Thus, it is apparent that we may lose sight of other valuable remedies, and attribute more credit to carbolic acid than it deserves, when compared with other antiseptics, which have not had the advantage of being tested in the same systematic manner of application; for it has doubtless been observed by many surgeons who have used these remedies to an extent sufficient to compare their relative merits, that where the carbolic acid is applied directly to a wound which is afterwards left unprotected from atmospheric influences—as is generally the case where the zinc and creosote are used—that it possesses no advantages over these latter remedies in facilitating the healing process.

In our own experience we must confess that we have seen much better results from the use of the chloride of zinc when applied in this way, than we have from the carbolic acid, especially on the flaps of stumps after amputation. But by this we do not wish to be understood as averse to the use of carbolic acid, or as questioning the numerous good results that have been claimed for it; only we think that its acknowledged precedence over other antiseptics is due more to the studied manner of applying it than to the superior merits of the remedy itself. The greatest advantage we can admit it to possess over the zinc, is that it is more volatile and for this reason more applicable than the zinc as a protective dressing, if the theory of atmospheric germ poisoning, propounded by Prof. Lister, be true.

But its value in preventing, or arresting septicæmia in the case of wounds, for which so much has been claimed for it by its more zealous advocates, we think a much more extended experience will be required to determine. Even though it may possess advantages in this respect, from its volatility and consequent destruction of the low orders of germinal life which are claimed to determine putrefaction and blood-poisoning—as this is the only *modus operandi* that can be claimed for it in effecting this result—we cannot see in what particular its claims are paramount to bromine, which is much more volatile and at the same

time is acknowledged to be destructive of all zymotic poisons. Sir James Y. Simpson,* in alluding to this subject, says, "that in the Hôtel Dieu, of Paris, M. Maisonneuve, one of the most distinguished of living French surgeons, used, from 1861 onward for a succession of years, carbolic acid in dressing the wounds, &c., of his patients, though he has now abandoned it for, I believe, alcoholic and other applications. But I am not aware that it was observed to diminish in any degree the prevalence of pyæmia among his patients."

"That, since Prof. Lister adopted, and wrote on the use of carbolic acid in 1867, it has been employed extensively in most of the surgical wards of the Royal Infirmary of Edinburgh. During the eight years, from 1859 to 1866 inclusive, before the introduction of carbolic acid here, the death-rates (chiefly from pyæmia) among the limb-amputations, amounted to forty per cent. During the two years, 1867 and 1868, this dreadful mortality rose to fifty-three per cent. This increased death-rate was not, I believe, directly owing to the introduction and free use of carbolic acid in the wards during these last years, for such death-rates are liable to intermittent changes from time to time; but, at all events, the increased mortality was despite the employment of the specific safeguard."

In the report of St. George's Hospital, Vol. iii., 1868, Drs. Holmes and Holdernessee give the treatment of forty cases by Prof. Lister's method of applying carbolic acid, and the results, the authors say, "are not in themselves striking; nor can we affirm decisively that they are better than would have been attained under the ordinary methods of treatment. Erysipelas, pyæmia, diffuse cellular inflammation, and tetanus—these formidable complications of wounds which we hoped to banish by the adoption of this method—have, as it will be seen by the sequel, claimed their proportion, and not a very small proportion either, of the number under treatment." These gentlemen conclude their report by stating that the treatment by carbolic acid "has not proved either painful or dangerous, and benefit is still hoped

* Medical Press and Circular, October, 1869,

for from its further use, and from trials of different methods of applying it."

Thus, it would seem that carbolic acid is not so infallible as an antiseptic remedy as one would be disposed to believe from the tone of Mr. Lister's reports upon the subject. The theory that this remedy is a destroyer of low germ-life, which was first advocated by Lemaire, DeClat, Bottini and others, and since revived by Prof. Lister, is not an established fact by any means; at all events, this fact is too far from being demonstrated to rest the entire theory of its action upon this basis. Dr. Watson, of Glasgow,* has expressed his views very fully upon this subject, and thinks that the air-producing theory of fermentation is incorrect, and that the rationale of carbolic acid is mainly attributable to two effects, which *all* antiseptic substances produce. First, it coagulates albumen, and thus renders the surface to which it is applied firmer, and enables it to resist the action of the air. Second, it keeps in the fluid discharges, and since the carbolic acid is volatile, and contains a large percentage of carbon, it feeds the oxygen of the air, and saves the carbon of the tissues which is so largely consumed in the respiratory process that takes place in an open wound. However, these mooted theoretical points do not materially affect the practical results derived from the use of carbolic acid, which are probably over-rated in some respects; yet, compared with other antiseptics, we regard it equally as good, and it may be, with our present knowledge of its systematic application, preferable to other remedies of its class, concerning the proper application of which so much is not known.

As to the rules determining an indication for its use, we may simply say that it may be applied directly to a recent wound, though not sufficiently concentrated to act as a cautery; while on the contrary it should never be applied directly to a granulating surface that does not require stimulating, but may be applied *over* such surfaces as a protective dressing, avoiding its contact with the raw surface. Lastly, it should never be applied in contact with recent cicatricial tissue, which it is almost certain to abrade and ulcerate.

* Glasgow Medical Journal, November, 1869.

ANTISEPTIC AND ANIMAL LIGATURES.

Probably most that we know of the antiseptic and animal ligature is due to the indefatigable Mr. Lister, whose experiments in this direction have thrown much light upon the use of the ligature, and doubtless divested it of many, it may be all, of its disadvantages. Mr. Lister's first experiments with the antiseptic ligature were made upon the lower animals, in which he used the common purse-silk, first treated with carbolic acid in the following manner:*

He steeped the ligature for some time in a saturated watery solution of carbolic acid, then applied it to the carotid artery of a horse, sufficiently tight to sever the middle and internal coats of the vessel, cut the ends short and treated the wound freely with a solution of carbolic acid in four parts of olive oil. Ten days after the operation he removed the dressings and found the wound perfectly united throughout; no pus, or even serum being found about the sutures upon their removal. Five weeks after the vessel was tied, the animal died from causes not connected with the operation, when, upon examination of the vessel on the cardiac side of the ligature, there was found an adherent coagulum, an inch and a quarter in length, while on the distal side there was no clot to be seen. The ligature was found embedded in a firm fibrous structure, with not only no pus, but no granulations or softening of tissue around it. The portion of the external coat included in the noose, though doubtless killed by the violence with which it was pinched, had not been thrown off as a slough, but, being unstimulating, because undecomposing, it had been absorbed and reproduced by the living parts near it; while the thread had been bridged over externally by dense fibrous tissue, so that the vessel showed but little appearance of constriction where it had been tied, and appeared to be as strong at that part as any other. The ligature, upon removal, was found to be unchanged.

Prof. Lister felt sufficiently encouraged by the success of this

* British Medical and Surgical Journal, August, 1865.

operation to carry the method into human surgery; and on the 29th January, 1868, he applied the antiseptic silk ligature to the external iliac artery, in a woman fifty-one years of age, for a femoral aneurism, cut the ends short, and closed the wound by wire sutures, and applied antiseptic dressings of carbolic acid. In a fortnight these were removed and the wound found to be quite free from pus, and perfectly cicatrised where the sutures had been introduced. Prof. Lister saw the woman twenty-five weeks after the operation, when her health had improved very much, and the wound remained perfectly cicatrised, with no evidence of irritation from the remaining ligature, which had probably become encysted as an inert substance in the tissues.

Dr. Maunder, surgeon to the London Hospital, also reports one case* in which he ligated the common carotid artery for aneurism, after the plan of Prof. Lister, continuing the antiseptic dressings for a month, when the wound was found to be completely cicatrised, without the ligature having been removed or exciting the least irritation or suppuration.

The number of cases reported in which the antiseptic ligature has been successfully used are too numerous to detail, and quite sufficient to establish the fact that it must possess advantages over the common ligature; and if time and farther experiments should verify the good results in Prof. Lister's practice, we have reason to expect that it will one day supersede all other methods of arresting arterial hæmorrhage, especially where immediate union is desired in a wound, or where it becomes necessary to ligate a vessel in its continuity, where, if all that is said of the method be true, it must give great additional security against secondary hæmorrhage by preventing suppuration of the vessel.

As we have had no experience in the use of the antiseptic ligature, it may seem out of place in us to question the advantages claimed for it, but as it is a fact well known by every surgeon experienced in the use of carbolic acid, that it will not prevent suppuration or sloughing in every wound, however judiciously applied, it is reasonable to suppose that greater immunity from these results would hardly pertain in ligation of vessels. We

* Brit. Med. Jour., Aug., 1868.

presume, therefore, that a more extended experience will be required to establish this practice as fully in the confidence of the profession generally, as is apparently accorded it by Prof. Lister, whose enthusiasm in the use of antiseptics may be such as to carry him a little beyond the success that will probably be attained in the hands of other surgeons, at least in his reported cases. Of his unreported cases, which doubtless far exceed those reported, we of course know nothing.

But making the allowance that it may fail in some instances, we have no doubt but that the antiseptic ligature is a most valuable discovery in surgery. The very fact that it has been successful in the comparatively few cases reported is sufficient evidence that there is truth in the principle, but to what extent it may supersede other hæmostatics can only be determined by a more universal experience in its use.

The *animal ligature*, which has recently come into more general use, seems to possess some advantages over the ordinary cord used for that purpose. The advantages claimed for this ligature are, that being itself an animal tissue, it is less irritating and requires a longer time to become decomposed when brought in contact with the living tissues; and further, that being identical with some tissues of the body it is more likely to be removed by absorption than would be the case with a substance entirely foreign.

Prof. Paul F. Eve, now of Nashville, informs us that he has entirely abandoned the silk, when he can procure the animal ligature, which he considers very much preferable. The ligatures he uses are stripped from the sinew of the deer, and applied without being first treated antiseptically, as has been done recently by Prof. Lister,* who uses the catgut previously steeped in a solution of carbolic acid with five parts of olive oil and a little water added, just sufficient to render the ligature flexible.

Professor Lister speaks of this ligature with such unbounded confidence that he states: "When we apply a ligature of animal tissue antiseptically upon an artery, we virtually surround it

* *Lancet*, April, 1869.

with a ring of living tissue, and strengthen the vessel where we obstruct it." He says further, "that he would without hesitation undertake ligation of the innominata, believing it to be a safe proceeding."

As we have never applied the animal ligature in any manner whatever, we are hardly prepared to venture an opinion upon its merits. But upon the authority of these gentlemen we should be disposed to accredit it with advantages over the common silk ligature, believing it to be true, that animal tissue is less offensive when brought in contact with the living tissue of the body. This we should think especially true of the antiseptic animal ligature as prepared by Mr. Lister, which seems to be rapidly gaining the confidence of the profession, especially in Europe. More time, however, will be required to develop the merits of this method and test its superiority over the common silken ligature.

VARICOCELE.

We do not propose to discuss either the causes or the pathology of varicócele, with which every surgeon should be familiar, but mention the subject only to speak of its treatment and radical cure, having in view the relief of the two chief conditions exist-are liable to cut into the skin if much swelling occurs, as is not unfrequently the case—and water or carbolic acid dressings applied.

I have operated by this method five times since January, 1868, in each case successfully, and promptly relieving the varicocele, and as I have since been informed by patients operated on eighteen months ago, without in any way impairing the function of the testicle. Although both the artery and the nerves are included in the écraseur, the length of time required to obliterate the blood vessels is not sufficient to impair the function of the nerves after the compression had been removed.

In operating by this method, it may be asked whether the nutrition of the testicle is not impaired by cutting off the circulation in the spermatic artery which is included in the ligature?

The result of the cases operated upon, in which neither atro-

phy, or impaired nutrition of the testicle was observed, has demonstrated that the collateral circulation is sufficient to maintain the nutrient function of the organ. The pain, which was quite intense before the operation, was immediately relieved, and eighteen months after the operations there was no indication of the disease returning.

A few months after performing this operation for the first time, and without any previous knowledge of the fact, I noticed in the 19th volume Transactions American Medical Association, a report upon this subject by our late townsman, Prof. Paul F. Eve, in which he states that he had frequently performed the operation as recommended by Sir Astley Cooper, with the addition of ligating the *veins* of the cord *only* with the animal ligature, which he allowed to remain until it was cast off. Professor Eve also notices in his report that Prof. Nathan R. Smith, of Baltimore, mentions having performed the operation of Sir Astley Cooper and ligated the veins successfully several years since, without his (Prof. Eve's) knowledge.

The almost coincident assertion of the success of this operation by two distinguished members of the profession, so far as they have performed it, encourages me to feel that I am correct in the advanced step that I have made in including the entire ing in every case, *i.e.*, a redundancy of the scrotum and a varicose condition of the veins.

The various methods of treatment long in use, such as incisions, cauterizing paste, subcutaneous ligation of the veins, etc., are too familiar to every surgeon to require mention. The latter method, that of occluding the veins by percutaneous pressure or ligation — which at the present day is the most common practice — we regard as unsafe, from the fact that in many cases the induration about the veins is such that it is impossible, by manipulating through the skin, to distinguish the difference between the hypertrophied veins and vas deferens, so that the serious mistake of including this duct in the ligature might occur in the hands of the most skilful operator. To avoid this accident, we have devised an operation which is not liable to such objection.

This operation consists in excising a portion of the redundant scrotum, by taking up a fold of it between the blades of a forceps, or with Ricord's fenestrated forceps for phimosis, and thus exposing the cord with its vessels, so that they can be manipulated separately, and the veins distinguished from both the artery and vas deferens. This part of the operation was originally proposed some years since, by Sir Astley Cooper, who after excising the scrotum brought the edges of skin together by sutures, relying upon this procedure to effect a cure. I, however, after the fold of scrotum has been removed and the vessels of the cord exposed, so that the vas deferens can be isolated, pass a needle around with a wire ligature beneath the cord, excluding the vas deferens and including all the other contents of the cord. The needle is then disarmed and the two ends of the wire passed through a small tube about two inches in length, and wound over a cylinder fixed at the other end of the tube, so as to grasp the vessels like an *écraseur* and compress them sufficiently to arrest their circulation, and induce their complete obliteration.

After the lapse of thirty-six or forty-eight hours the "*écraseur*" is removed, the wound closed by the ordinary interrupted sutures or needles—the former being preferable, as the needles contents of the cord in the *écraseur*, excluding only the vas deferens. The results being quite as satisfactory in my cases as in those of Professors Eve and Smith, I have reason to believe that the cure will be more permanent, from the fact that not only are the veins obliterated, but the main artery also, thus rendering the desired result doubly certain. The operation is comparatively devoid of all danger, as any excessive inflammatory action may be controlled at once, by cutting the wire and withdrawing the *écraseur*. The *écraseur* used in performing this operation will be found illustrated in the following article upon the radical cure of hydrocele, in the performance of which it is likewise used.

HYDROCELE.

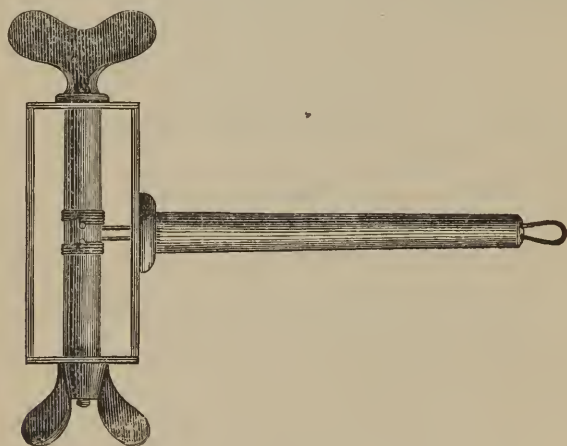
The causes and pathology of hydrocele we do not propose to

discuss, but shall allude only to the treatment, with which also, so far as the established methods of operation for its radical cure are concerned, the members of the society are doubtless so familiar as to render reference to them unnecessary were it not that we have some improvements to suggest. The more popular of these operations—tapping, followed by stimulating injections, such as wine, iodine, sulphate of zinc, &c., into the tunica vaginalis—although often successful in effecting a radical cure, is by no means infallible, while the amount of pain and inflammatory action which occurs in almost every case, is, we think, sufficiently alarming to induce us to seek for other measures less severe, particularly when we know that such treatment, with all its severity, cannot always be relied on for a permanent cure, from the fact that adhesive inflammation of the walls of the tunica vaginalis, as is supposed by many to result, thus obliterating its cavity, rarely if ever occurs.

On the contrary all that can be expected from the use of these injections is by their stimulating effect to restore the balance between exudation and absorption, the latter of which is defective. But even though this may be re-established by these remedies we have no guarantee that a relapse will not sooner or later occur, unless the cavity of the tunica vaginalis should become obliterated by an excessive inflammation, a result which is probably never achieved, and ought not to be sought for, considering the great danger, during the process, of destroying the entire scrotum.

The method of cure by the introduction of a seton is both too tedious and too painful to be resorted to when other remedies can be made available; but in cases where the testicle should be found to be diseased, we should regard the seton as a safer remedy than injections, as it is less likely to incite a serious inflammation, though probably not so certain to effect a cure. The simple operation of incising the scrotum and evacuating the fluid, as practiced in some cases, and forms part of the operation to which we wish to direct attention, may be regarded as a harmless procedure so far as the danger of consecutive inflammation is concerned, but we do not think it can promise much hope of a radical cure.

The operation which we have recently practiced successfully in the cure of hydrocele, consists in making an incision about two inches in length over the region of the cord, and extending for the most part into the tumor, by which the fluid of the sac is evacuated and the cord with its contents left exposed, so that in the subsequent steps of the operation, there is no possible danger of including the vas deferens in the wire ligature, which is then thrown around the cord by means of a needle armed with a wire. The needle is then detached and the two ends of the wire are passed into and through a canula—as shown in the accompanying diagram—and after being tightened sufficiently



to arrest the circulation of the vessels of the cord, is then fastened around the cylinder at the other end; but the loop should not be drawn so tight as to cut the vessels or nerves.

This appliance is allowed to remain for thirty-six to forty-eight hours, when the wire is snipped and removed without disturbing the wound, which should be previously closed by sutures. The advantages of this operation are:

First. The certain obliteration of the blood vessels, and the impossibility of the hydrocele returning, while the collateral circulation is quite sufficient to maintain the nutrition of the testicle, which we have never known to become atrophied after the operation.

Second. An inflammatory process is not necessary to effect a cure, and this by this method is avoided, with all its dangers.

Third. The cure is effected more speedily, only requiring the patient to be confined for five or six days, during which time he suffers no pain after the removal of the écraseur.

Fourth. There is less danger of doing any injury to the testicle than when stimulating injections are used.

I have performed this operation four times, in three of which I compressed the contents of the cord (excluding the vas deferens) with an ordinary silk ligature, which was allowed to remain for several days longer than was at all necessary to obliterate the vessels, while at the same time there was greater danger of impairing the function of the nerves by compressing them for so long a time. For this reason and the less amount of time required in completing the cure, I was induced to resort to the wire écraseur as I have just described, with which my expectations were fully realized in the result. I am fully convinced that this operation is safer, less painful and more certain of effecting a radical cure than any other method now practiced. I do not deny that a large per cent. of cases may be cured by the ordinary operations in general use; yet, it is well known that they not unfrequently disappoint us in the result, and for that reason I am more favorably disposed to an operation that it is scarcely possible can fail in a single instance, from the fact that the current of the circulation is thrown into another channel and the vessels at fault in producing the disease are sealed up and no longer capable of reviving the same conditions.

INGUINAL HERNIA.

As this is a subject with which every surgeon is presumed to be familiar, we shall only direct attention to the reducible form of it, with a view to the consideration of its *radical cure*.

There is probably no other condition requiring surgical relief for which such a variety of operations has been devised as reducible inguinal hernia, and certainly none the operations for which have been so generally unsatisfactory in their results. In fact,

surgeons have so long exercised their utmost ingenuity to devise some safe and reliable means of relief, and, however rational in principle, every variety of operation has so frequently failed, that the radical cure of this affection would almost seem to be beyond the reach of artificial means.

Until within the last half century all the methods devised for the permanent relief of hernia were severe, cruel and dangerous — not unfrequently followed by death. The object of these operations was to obliterate the sac, or obstruct its neck, by such methods as cauterization, excision of a part or the whole of the sac, sutures, ligature, and even in some instances castration. The original operation by the cautery was to apply the caustic over the skin and thus excite an inflammation and suppuration which it was hoped would obliterate the cavity of the sac; but the process was followed by such a degree of mortality and percentage of failures, that it was subsequently modified by Monro and others, who made an incision into the neck of the sac and then applied the caustic; but this method proved to be no less severe or dangerous in its results, and M. Velpeau again modified it by making a similar incision and using a mild injection of iodine sufficiently concentrated to excite merely an adhesive process in the sac. The method of M. Velpeau was much less severe and dangerous than the former use of caustics, but we are not aware that it was much more successful in its curative results. At all events the practice soon fell into disuse, and we think was abandoned by M. Velpeau himself. Soon after this period Dr. Pancoast, of Philadelphia, proposed a modification of M. Velpeau's method by using hypodermic injections of iodine over the neck of the sac, and thus avoided exposure of the peritoneal cavity by incision. This method seemed to meet with more favor than M. Velpeau's, — at all events a larger number of cures was reported from it, — but a majority of the favorable cases that we have seen reported were lost sight of too soon after, to determine the merits of the operation. The danger, however, from this operation was doubtless less than from Velpeau's method, while the prospect of success was equally as good.

The *ligature*, which probably ranks next in antiquity to the cautery, was applied in a most barbarous way. The entire sac was ligated, including the cord and testicle, which caused the whole to slough away.

The *suture*, which followed next in order, was less objectionable from being less cruel and not destroying so much of the contents of the scrotum. By this method, the viscera were first returned and the neck of the sac sewed up by the continued suture, without making any incision through the skin. This operation, however, soon fell into disuse from the great danger attending it and its frequent failures to effect a cure.

Excision of a part or a whole of the hernial sac, including the integument of the scrotum, was also practiced for a time with a hope of success, but was found to be more dangerous than the suture and attended with no better results.

The numerous failures following all these operations, still encouraged other devices, amongst which that of forcing the testicle into the external ring was practiced for a time, with the hope that by exciting an adhesive inflammation about it, a radical cure might be effected from thus obstructing the point of escape of the viscera. This, too, being alike unsuccessful as well as dangerous in its results, the hope of discovering a permanent cure for hernia was quite abandoned by the regular profession, and its treatment for a time fell into the hands of pretenders and charlatans, not a few of whom were females, who practised some method profoundly secret to the patient, consisting usually of stimulating ointments applied externally, and not unfrequently castration, which was done without the knowledge or consent of the patient. After this period of superstition and charlatanism had progressed to such a degree of abuse as to again demand the interference of the profession, M. Gerdy devised a more safe, and it was thought more hopeful operation, which consisted in removing the cuticle by means of caustics, and forcing the abraded integument into the inguinal canal. This operation was performed by M. Gerdy thirty times, and a large per cent. of favorable results reported, but M. Velpeau, from his own experience in operating by this method, as well as

from his observation of cases previously operated upon by M. Gerdy, was induced to discredit the operation and abandon it. It was, however, probably less dangerous and more rational than many that had preceded it; at all events, that part of the operation which consists in cauterizing the invaginated integument has recently been imitated by Mr. Wurtzer, who, as an improvement upon his former method, now smears the plug of wood which he uses to invaginate the scrotum into the inguinal canal, with some stimulating substance, such as cerate of cantharides, with the view to excite adhesive inflammation between the walls of the sac. The method proposed by Mr. Wurtzer, it will be remembered, consists in invaginating a portion of the scrotum into the inguinal canal by means of a canulated or grooved stick or plug, which is passed through the extent of the canal and held in that position by passing a long needle through the canal or groove and forcing its point through the skin over the abdominal walls; a second stick is then placed parallel to the first and attached at one end to the point of the needle, and at the other to the handle of the needle, the two pieces acting as a clamp to hold the invaginated scrotum in position until adhesion is supposed to have taken place between the walls of the sac—embracing usually a period of six or seven days—when the clamps are removed and the adhesions expected to be sufficiently secure to prevent the subsequent escape of the hernia.

Though Mr. Wurtzer reports a thousand cases treated by this method, the results, as mentioned, of many of them are not such as to determine the real merits of the operation, as in many cases sufficient time had not elapsed to justify a report of the cases as permanent cures.

We have not been able to ascertain the results from the improved method of operating with Mr. Wurtzer's instrument, by the use of the cantharides cerate, but we are disposed to regard it favorably, and believe that in most cases it will be more likely to insure better results; but even with this improvement, the method is still objectionable for reasons which we will allude to hereafter.

Since the introduction of Mr. Wurtzer's method, M. Bonnet,

of Lyons, has attempted a new means of exciting inflammation, with the view to close the sac, by passing from two to four pins transversely through the neck of the sac and clinching them at either end over a cork. The pins are then allowed to remain until a sufficient adhesive inflammation has taken place, when they are removed. This operation, like some others that we have mentioned, is attended with but little danger, yet the results obtained are not more encouraging than had been derived from Wurtzer's method.

Prof. Greenville Dowell, of Galveston, Texas, published in 1866 a method somewhat similar to M. Bonnet's, performed by passing three or four wire sutures through the columns of the external ring, thus approximating their edges and fastening the wires over a cork externally without making any incision through the skin, the sutures being subcutaneous. Prof. Dowell reports very favorably of this operation. Though it sometimes fails to effect a radical cure, he thinks it guarantees a better hope of success than any other operation in use. But while this method is evidently an improvement upon that of M. Bonnet, it may have been designed as a modification of Wood's operation, which antedates it, and which consists in first reducing the hernia, then making an incision through the integument so as to allow the finger to be passed up to the columns of the external ring, through which a long curved needle is passed on either side, armed with a wire, the two ends of which are twisted together, thus drawing the columns together, with the view to excite adhesion between their edges, and thus prevent the escape of the viscera after the wire has been removed, at the expiration of eight or ten days. This latter operation has been somewhat modified by Dr. Chiselm, of South Carolina, who inserts the sutures much in the same manner, but after approximating the columns, cuts the wires short, leaving only the knots of wire which are expected to become encysted. It was thought that by this operation the plastic exudation from the tendinous structure of the columns would organize more permanent adhesions than from any other tissue that might be excited for that purpose. But as we have no evidence that new formations from fibrous tissue are more perma-

nent or stable in their nature than from other tissues, there is no reason why these operations should claim precedence over others which have been equally successful in their results. Though Drs. Wood and Chisselm claim a large proportion of cures resulting from their operations, yet it is probable that many of their cases were reported prematurely, leaving some doubt as to how many were actually cured. Our own observation of these operations, though quite limited, has not been such as to impress us very favorably with the results, though doubtless they have often been successful. We do not believe the principle as correct as the operations by invagination of the scrotum as practised by Mr. Wurtzer.

Dr. George Allen, of Springfield, Illinois, has also reported an operation, upon the same principle as that of Prof. Wurtzer, which consists in invaginating the scrotum by means of a silver canula in which a bullet is lodged to secure the end of a wire, which is passed out through the wall of the abdomen and secured over a button upon the external surface, thus holding the canula with the invaginated scrotum in position until adhesion is supposed to have taken place between the walls of the sac, usually embracing a period of from twelve to fourteen days, when the canula is removed by severing the attachment of the wire to the button. Dr. Allen has reported fifty cases treated by this method, with forty-eight cures,* which is certainly better results than have been secured from any other operation. The doctor, however, was not particular to state what time had elapsed after his operations until his cases were reported, and as time is an object of much consideration in determining the result of any operation for the cure of hernia, a like doubt exists in Drs. Wood and Chisselm's cases, as to how many may eventually prove to be permanent cures.

But we have already enumerated a sufficient number of operations for the radical cure of hernia, with their uncertain results, to indicate that the correct principle has not yet been devised for the radical cure of inguinal hernia. Indeed it would seem

* Transactions Ill. State Med. Society, 1868.

to be a true defect of nature, not intended to be remedied by any artificial means now at our command,

Without presuming to have perfected an operation which has so signally baffled the ingenuity of every surgeon who has attempted it, we venture to offer still another method of cure by means of invagination, something after the manner already alluded to, the details of which we believe having never been practised previous to our performance of it, we shall therefore claim as our own.

There is required for the performance of this operation a leaden bullet, about the size and shape of an ordinary minié ball, cast with a piece of annealed wire, from six to ten inches in length, extending from its apex; a strong needle, about six inches long, with an eye near its point, and of suitable curve, and a hollow wooden compress with a cup or bell-shaped concavity, about an inch and a half in depth and two inches and a half in diameter, with an opening at the apex for the passage of the wire. With the index finger the scrotum is invaginated within the inguinal canal as far as the internal ring. The needle, with the distal end of the wire passed through the eye, is then carefully passed along the palmar surface of the finger, through the canal, as far as the inner ring, when it is passed directly forward through the abdominal wall, and after being disarmed of the wire is withdrawn. The bullet, with the invaginated scrotum, by traction upon the wire, and pressure with the finger within the canal if necessary, is carried to the internal ring, where the wire passes through the abdominal wall, and is there retained by passing the wire through the hollow compress and securing it over the apex. By the use of the hollow compress direct pressure is avoided upon the projection caused by the presence of the bullet in the canal, and to a corresponding extent the bullet prevented from making its way through the tissues before the invaginated portion of the scrotum has become adherent to the walls of the sac. Ordinarily, in from twelve to eighteen days, without being interfered with, the bullet makes its way to the surface, and together with the compress, is removed, leaving the scrotum adhered and invaginated in the in-

guinal canal. The length of time required for the wound to heal is ordinarily about a week. A light truss is then worn for a few days after the patient is allowed to get up, until the adhesions become sufficiently firm to restrain the protruding viscera.

My first intention in performing this operation was to attempt a cure by having the bullet become permanently encysted, and in order to facilitate this condition, I had the interior of the ball made of cork, so as to avoid the inconvenience of its increased weight and tension upon the walls of the canal. But after a short experience, finding that the ball would rarely become permanently encysted, I abandoned that idea, and since, for convenience, have had the bullet cast solid, and have allowed it to escape through the wall of the abdomen, which I think is more desirable, even though the ball should become permanently encysted, as its tension and weight when borne for a considerable time becomes painful and unpleasant, even when it retains the viscera in position.

I will refer to the comparative merits of this operation, after giving a detailed statement of the cases I have operated upon, which are as follows—numbering eleven cases and nineteen operations:

CASE No. I.—J. B., aged 37; admitted to hospital on the 18th February, 1869, with a left oblique inguinal hernia, the viscera filling the scrotum, was operated upon by inserting a solid ball on the 20th February; March 6 the wire was cut just beneath the skin, at the apex of the ball, which was allowed to remain. At the end of six weeks from the date of the operation the ball seemed to be completely encysted, and the patient was allowed to get up, with no indication of the hernia returning, though for some time he complained of some pain and inconvenience, which he attributed to the weight of the ball. This, however, gradually subsided, and on the 1st of May, when he was discharged, the cure seemed to be perfect. I saw this patient two months later—making more than five months from the date of the operation—when the ball still remained in position, with no indication of a relapse of the hernia.

CASE No. II.—Barth. Hart, aged 54, admitted 14th Septem-

ber, 1869, with a double inguinal hernia. On the 18th September I operated upon the right side, by inserting a ball of the usual size into the inguinal canal. September 27th the ball, with the wire, came out through the wall of the abdomen, leaving the scrotum invaginated; but before the wound had healed, the scrotum dropped back again and allowed the hernia to come down, though not to the same extent as before. On the 23d November, I repeated the same operation on the same side. This time the ball, with the wire, came away on the 12th day, leaving the scrotum still invaginated, but as before, before the wound had completely cicatrised, the scrotum came down again, but the sac was so far obliterated as to prevent the viscera descending into the scrotum, allowing only a projecting tumor at the external ring.

His condition was so much improved, that an ordinary truss would control the hernia, which it would not do before.

On the 11th March, 1870, I operated upon the left side as I had done on the right. April 5, the wire rusted off at the point of the bullet, which could be seen. April 10, ball was removed and the scrotum remained well invaginated, with no indication of hernia returning. The wound soon cicatrised, and the patient suffered no more inconvenience up to the time I saw him last, on the 1st of July, 1870.

CASE No. III.—Benj. Corser, aged 54, was admitted on the 28th September, 1869, with a double oblique inguinal hernia extending into the scrotum. On the 16th October I operated upon the right side. On the 9th November the wire rusted off, leaving the bullet in the canal. Thinking that it might become encysted, I allowed the ball to remain until the 1st December, when, seeing it would not become encysted, I removed it, leaving the scrotum well invaginated. The wound soon cicatrised, without any indication of the hernia returning. On the 16th January, 1870, I operated in like manner upon the left side. Fifteen days after, the ball came away, and on the 23d February the patient was allowed to walk about the house, apparently cured of both herniæ. Eight months after the date of the first operation I had a letter from this patient, in which he stated

that the hernia had not appeared on either side, though he complained of some uneasiness on the left side, which induced him to wear a light truss as a matter of safety.

CASE No. IV.—John Harris, aged 24, admitted December 14, 1869, with a right inguinal hernia. December 16, operated in the usual way. January 9, the ball was removed with the forceps, the wire having rusted off. Scrotum remains invaginated. Ten days later, the patient was allowed to walk about, without pain or evidence of hernia reappearing. Soon after, however, a slight enlargement made its appearance, but was apparently confined to the canal, without coming down into the scrotum, as it had done previous to the operation. This case would doubtless have been further improved or cured by a second operation.

CASE No. V.—Louis Kern, aged 40—left inguinal hernia—operated in the usual way on the 2d February, 1869. In this case the ball was filled with cork. February 15, the invaginated scrotum came down, perforated by the bullet. February 25, ball removed. The wound cicatrised rapidly, and on the 26th April the patient was discharged, apparently cured.

CASE No. VI.—John Danckert, aged 48—right inguinal hernia; operated January 4, 1869. Ball came away January 22, leaving the scrotum well invaginated. The wound healed readily, and the patient was discharged May 10, apparently cured, with the exception of a slight impulse felt when coughing.

CASE No. VII.—George Swann, aged 37, was admitted August 28, 1869, with a double oblique hernia—that on the left largely distending the scrotum. This case had been in the hospital some months previous, and was then operated upon on the left side by Dr. Hodgen, by Wood's method, which seemed at the time to bid fair to effect a cure, but before he left the hospital, the adhesions gave way and the hernia became quite as large as ever. After this, I am informed, Dr. Gregory operated upon the same side by Chisselm's method, though with no better success than attended the previous operation.

August 31 I operated upon the same side by my method, and removed the ball on the twenty-ninth day, but very soon after the hernia came down again. Subsequently, I repeated the ope-

ration the third time, and with but little better results than from the first, except that the hernia could subsequently be retained by the use of a truss, which could not be done when he entered the hospital.

On the right side, where the hernia was much smaller, the first operation was sufficient to retain the viscera, and has continued to do so to the present time—nearly a year.

CASE No. VIII.—Henry Volkmann, aged 71; operated April 26, 1870; ball escaped May 10; wound healed readily. Hernia seemed to be cured, when he was discharged on the 2d June, but he returned to hospital in a few weeks with the hernia quite as large as before he was operated upon.

CASE No. IX.—Hugh Mills, aged 36, had a right oblique hernia largely distending the scrotum, for which he was admitted to hospital 26th October, 1869.

When in hospital the year previous, I operated upon this patient by Dr. Allen's method, as already described, but the result was a complete failure. Soon afterward, Dr. Hodgen performed Wood's operation, but with no better success. I now operated by inserting a bullet in the usual way, but the result being unsatisfactory, I soon after repeated the operation, which resulted in relieving his condition so much, that the viscera has not since descended into the scrotum, although it forms quite a tumor at the external ring, which, however, can be readily controlled by a truss.

CASE No. X.—Thos. Butler, aged 67, was operated upon in the usual way for a left oblique inguinal hernia on the 12th November, 1869. Nothing peculiar in treatment. Was discharged on the 24th December, apparently cured.

CASE No. XI.—Jas. Riette, aged 49, admitted with a right inguinal hernia. Operated 18th January, 1870, with a ball filled with cork, which came away on the 3d of February, and was soon followed by the escape of the hernia. In a few days after this result was observed, I repeated the operation with a similar ball, which became encysted in the canal, and remained there without giving him any inconvenience, and prevented the escape of the hernia up to the time of his discharge on the 19th April, since which time he has not been heard from.

A summary of these cases will show nineteen operations performed on eleven patients, with the following results: Cured, 7; benefited, 9; not relieved, 3.

The rationale of this operation is so apparent as to need but little explanation. The inflammatory action that results during the escape of the ball through the invaginated scrotum and abdominal wall, would seem to offer a better hope of securing union between the walls of the sac and the scrotal tissue than could be expected in either Wurtzer's or Allen's methods, in which the instrument with which the scrotum is invaginated is withdrawn at the same point at which it enters, thus allowing the scrotum in many cases to drop back again, or not unfrequently, if the point of the invaginating instrument projects with much force against the wall of the scrotum, it will soon perforate it and allow the skin to slip down on the instrument before any adhesions take place whatever.

Although the results of this operation as performed by me do not guarantee uniform success, I certainly believe the principle involved to be correct, and that the operation has the merit of being more simple and reliable than any other yet devised for the radical cure of the affection.

LITHOTOMY.

Our consideration of the subject of lithotomy we will confine to the different methods of operating, none of which seem at present to be well established with all surgeons as a rule of practice.

It seems that the ancients, as early as the third century B. C., were accustomed to remove urinary calculi by incision through the perineum, something upon the same plan as that practised at the present day. They, however, made the incision somewhat more extensive through the prostate and neck of the bladder, which, with their defective knowledge of anatomy, rendered the operation very unsatisfactory in its results, especially where large calculi were required to be removed. This method continued in vogue until the beginning of the fifteenth century, when Johannes de Romanis suggested as an improvement upon

this plan, the introduction of a sound into the bladder, and making an incision through the bulb and membranous portion of the urethra as far as the prostate, and then dilating the neck of the bladder, by means of conductors, until sufficiently large to admit the forceps and extract the stone. Amongst the many advocates of this operation, Marian was the first to declare it a success in his day, and insisted upon its superiority over all others, both as to its safety and the speedy recovery of the patient. But the length of time required in performing this operation, eventually rendered it unpopular, and in the year 1698, Frère Jacques introduced the lateral method, extending the incision through the prostate into the neck of the bladder, which was thought by him to be better than the tedious method by dilatation. This operation was subsequently practised extensively by Chesselden, but at first with great fatality, until modified in the extent of the incision, which was stopped short of completely incising the prostate, except in cases where the large size of the calculus actually required it. With this modification the operation was attended with much more favorable results, and continues to be the approved method at the present day.

In reviewing all the phases of success in the operation of lithotomy, it would seem that that method has invariably been the most successful in which the least extent of incision was required in the tract of the urethra. With this fact, every surgeon of the present day is familiar, and knows with what confidence of success he operates for the removal of a very small calculus, compared with that of a large one, where, perhaps, complete incision of the prostate is required, thus increasing the danger to the patient's life, as well as retarding his speedy recovery, not only by the extent of the wound inflicted, but also by going beyond the reflection of the ileo-vesical fascia, at the base and outer aspect of the prostate, in which case urinary infiltration is likely to follow with its fatal consequences. To avoid this extensive wound of the prostate and deep perineal fascia, is the great desideratum in the performance of this operation; for it is from urinary infiltration and suppuration of the prostate, that we are always appre-

hensive for the life of the patient in this operation. When these dangers do not exist, as in cases where small calculi are removed, requiring, perhaps, no greater incision than the extent of the membranous portion of the urethra, we are accustomed to make a favorable prognosis in every case where the constitutional condition of the patient does not contra-indicate such a result. We think, by comparing statistics, it is safe to estimate the recoveries in such cases at twenty-nine in thirty; whereas, considering the result of the operation in general practice, including those cases in which long posterior incisions are made, statistics show on an average, one fatal case in six. Nine-tenths of this fatality result from urinary infiltration, in consequence either of cutting behind the deep fascia, or the infliction of a wound of such extent, that the length of time required for it to unite will admit of urinary infiltration by the long continued suppuration, or from cystitis excited from injury to the bladder. The only means, then, by which we can obviate the danger of these results, is to avoid, as far as possible, the wounding of the prostate, the ileo-vesical fascia, and the neck of the bladder. Now this can only be done by dilatation instead of incision, and we doubt not if Marian, in the fifteenth century—who practised this operation with such merited success—had had the advantages of our more modern improvements in instruments, and known the use of chloroform, especially the latter, which is indispensable in this method of operating, this operation doubtless never would have fallen into neglect. In fact, without the use of anesthetics, we should be disposed to regard the operation by dilatation as impracticable, for the sensitiveness and irritability of the neck of the bladder is such, that it must necessarily be relaxed by some agent, before dilatation can be effectually accomplished, without doing violence to the tissues. It is to this fact that we mainly attribute the many failures in the operation of lithectomy recently performed by some surgeons in Europe, who attempted dilatation by means of sponges and Arnott's fluid dilator, which, usually requiring a period of twenty-four hours before any attempt at extraction could be made, of course precluded the possibility of using an anesthetic during so long a

time. This operation was also objectionable, as described by Willis, on account of the small incision made through the perineum, which, requiring dilatation of the external parts, rendered the process too protracted and painful to the patient, without the use of chloroform. But the dangers which can be avoided by the operation of lithectomy, or dilatation, with the use of chloroform, a larger external incision, and *immediate* dilatation of the neck of the bladder by proper instruments, are just such as should commend it to the surgeon. The steps of this operation are the same as those of the ordinary lateral operation, but entering the membranous portion of the urethra immediately behind the bulb, and carrying the incision back to the anterior edge of the prostate, which, considering the readiness, when the patient is anæsthetized, with which dilatation of the prostatic urethra may be effected by the finger and forceps, without lacerating the tissues, it is unnecessary to incise when even a large stone has to be extracted, as I have demonstrated quite to my own satisfaction, after having operated four times by this method. In one instance, in which the stone measured an inch and a half in diameter, the patient, a young subject, after the lapse of a few hours, had perfect control of the sphincter of the bladder, and much sooner than usual voided all his urine *per vias naturales*. In another case—less fortunate in the result—where the patient was suffering such intense pain from cystitis that I was compelled to operate to give him relief, I removed a stone one inch in the diameter in which it was extracted, but the patient, although much relieved of his former pain by the operation, was already so far prostrated that he died within thirty-six hours. The *post mortem*, made immediately after death, found the prostate in a normal condition, with no marks of any injury whatever having been inflicted in consequence of the operation.

Dr. David Prince, in a report made to the Illinois State Medical Society in 1867, favors this method of operating, and asserts that he removed a stone two inches and a half in diameter, with no evidence of having lacerated the prostate.

Dr. Edwin Powell, of Chicago, who was on a special committee to report upon this operation to the Illinois State Medi-

cal Society, at its regular meeting, in Chicago, in 1868, reported decidedly in favor of the operation by dilatation of the neck of the bladder without incising the prostate, and asserts that even large sized calculi may be removed by this method.

I have repeatedly, while in hospital, tried the experiment upon the warm cadaver, immediately after death, before the *rigor mortis* was established, and have been able to remove an ordinary sized patella from the bladder, without cutting or lacerating the prostatic urethra.

Dr. J. M. Wood, of Kansas City, informs me that he has operated about thirty times by a method somewhat similar to the above, except that he makes a semilunar incision through the perineum in front of the anus, then entering the membranous portion of the urethra behind the bulb, carries the incision through the anterior half of the prostate gland on the left, after which he dilates the remainder of the prostate and neck of the bladder. He asserts that the anterior portion of the prostate gland is much less dilatable than its posterior portion, and in case the stone is found to be of great size, also incises a portion of the right lobe of the gland. Dr. W. asserts that his success by this method of operating has been most remarkable, that he has never had a case followed by urinary infiltration beneath the perineal fascia, and that the urine usually passes by the urethra *after the first day*, and that most of his patients have been able to leave their rooms about the third day. Thus it will be seen from the statement of Dr. Wood, that the prostate is much more readily dilated than many surgeons have been willing to concede, and while his experience has not demonstrated the dilatability of this portion of the urethra to the same extent as in the cases previously referred to, yet so large a number of successful operations, with the degree of dilatation effected in his cases, go far to confirm the fact of the dilatability of the prostate and neck of the bladder.

Prof. Paul F. Eve, of Nashville, has kindly furnished me a report of ninety cases operated upon by himself. Of these cases seventy-eight were bi-lateral, three lateral, three lithotrity, two high, two vaginal section, one urethral section, and one by dila-

tation. Of the seventy-eight cases cut bi-lateral, eight died; of the three lateral, two died; of the two high, one died; making in all eleven deaths, or one in eight and two-elevenths. Thus it will be seen that Prof. Eve prefers the bi-lateral operation, which, from the statistics given above, would seem to afford the best result, and indeed the mortality in these cases is very low, when reviewing the complications attending some of the fatal cases. Yet, this does not invalidate the fact that large sized calculi may be extracted without incising the prostate or making an external bi-lateral incision; thus avoiding the danger of urinary infiltration behind the perineal fascia where the prostate is severed to any considerable extent in the operation.

As every member of this Society is doubtless familiar with the appliances in general use in the treatment of fracture of the clavicle, we will not occupy time in pointing out the defects of each in detail, but will merely call attention to a method of treatment, by which we have treated several cases with most satisfactory results, and which we conceive to be based on correct principles.

Although the displacement in this fracture is to a great extent uniform, there is by no means a uniformity of opinion among surgeons, as to the cause operating to produce the displacement, and hence a corresponding diversity of opinion as to the indications to be made in treatment of the fracture. It is generally held that the outer fragment, with the shoulder, is depressed by the weight of the arm dragging downwards, which is doubtless true to some extent, but recent investigations direct attention to other important coöperative factors. Those of Drs. J. H. Packard, Hartshorne, and Wales* seem to indicate the displacement of the fragment as more directly due to the action of the scapular muscles. Dr. Packard thinks the serratus magnus and pectoralis minor, are the chief agents—together with the weight of the arm—in dragging the shoulder down, in which opinion Dr. Hartshorne concurs, but thinks that the rhomboidei and levator anguli muscles also contribute to the displacement, in addition to which, the effect of the trapezius muscle is to draw the scap-

* Pennsylvania Hospital Reports, 1869.

ula with its accromial attachments downward, and at the same time, owing to the rotary latitude of the bone, to approximate its inferior angle toward the spinal column, and also, project it backward. Drs. Coats, Hind and others, while agreeing that the displacement is mainly caused by the action of the scapular muscles do not agree as to the particular muscles; nor is this practically material, so long as we are able to exert an opposing force sufficient to replace and maintain the scapula in proper position to secure correct apposition of the fractured clavicle.

Indeed, although this accurate knowledge of the exact anatomical causes producing the displacement ordinarily met with in this fracture, is of comparatively recent origin, the practice resorted to for the correction of the displacement, and rational treatment of the fracture, to which we would direct attention—confining the patient on his back, with a pillow or compress between the shoulders, thus allowing the weight of the shoulders and arms to counteract the action of these muscles while the pressure along the spinal margin of the scapula causes this bone to resume its normal position—is substantially the same as was practised in the days of Hippocrates, and subsequently recommended by Velpeau.

This method, Dr. Hartshorne states, has been practised in the Pennsylvania Hospital for several years, to the almost entire exclusion of all other methods, and with more favorable results than were derived from the use of any apparatus yet devised for the treatment of this fracture. He is disposed, however, to attribute the most benefit to be derived from the enforcement of this position, to the pressure made on the lower angle of the scapula, which tilts, as it were, the accromial angle back into position, and thus corrects the displacement in the fracture, though at the same time this process is aided by the reflex action produced in all the muscles bearing on the scapula, as well as relief from the dragging weight of the arm.

To what extent the benefits derived from this method of treatment are attributable to relaxation of the scapular muscles, we are not prepared to express an opinion, but having treated several cases by this method during the past two years, we are sat-

ified that we have secured better results from it than from any apparatus we have ever used, and feel confident that where the recumbent position can be strictly enforced, with a large pillow or compress between the shoulders, sufficient to cause the weight of the body to rest on the scapulæ, allowing the shoulders to project over the edges of the pillow or compress, that it is superior to any method of treatment yet devised.

It may be urged that this treatment is less applicable to private practice than for hospital use, where more rigid obedience can be enforced, but this does not invalidate the principle, which is certainly the correct one, and is deserving of much consideration, with a view to devising some appliance by means of which suitable pressure upon the scapula can be made available as a means of retaining the fragments of the fractured clavicle in apposition, without restraining the patient in the recumbent position.

FRACTURES OF THE INFERIOR MAXILLA.

The difficulty experienced by every surgeon in treating fractures of the lower jaw, with the ordinary appliances now in use has been such, that, after reviewing the subject briefly, I venture to present an interdental splint for the treatment of this fracture, which I have used in a number of cases, with excellent results, and which I think from my experience with it will obviate most of the difficulties referred to. The following text I quote from my publication on this subject in the *Medical Archives* for October, 1869.

I should feel reluctant—especially after the degree of favor shown some of them by such men as Boyer, Malgaigne, Erichsen, Fergusson, and others, as well as our own successful experience in certain cases—to assert that all the appliances in use at the present day for treating this fracture, are useless, or in every case unsuccessful; but after considerable experience with most of them, varied according to the peculiar circumstances attending each case, I cannot but consider the cases very few to which any of them are well adapted. There are too many coincident conditions necessary in each case, adapting the fracture to the conformation of the apparatus, rather than the apparatus to the conformation of the fracture. In cases where there is but slight

displacement of the fragments, the teeth complete and evenly arranged in both jaws, with sufficient of them absent, at a point where their resistance is not required to maintain the proper position of the jaw, to allow the patient to receive nourishment, some of these appliances are as efficient as could be desired, but unfortunately there are but few cases in which all these conditions exist.

Where there is considerable displacement in the fracture, and the opposing teeth in the opposite jaws are irregular or wanting on either side, and where all the teeth in front are complete so as to prevent the patient taking food while the jaws are clasped together, the apparatus of Gibson, Barton and Hamilton, all of which act upon the same principle, with a sling bandage passing beneath the jaw and over the top of the head, and another bandage passing in front of the chin to extend around the back of the head, are objectionable. This latter bandage, especially in a fracture of the body of the bone on both sides, must evidently have the effect to increase the displacement by drawing the anterior arch backward, thus increasing the already existing tendency of the inferior maxillary muscles in that direction, while the sling bandage, by clasping the jaws firmly together, not only prevents the possibility of the patient taking food into the mouth if the teeth are complete in both jaws in front, without removing the dressing every time he wishes to eat, but, also, if there be certain irregularities of the teeth in either or both jaws, the displacement may not only not be corrected, but actually increased when the jaws are clasped together in this manner. For instance, if the fracture be through the body of the bone, and the teeth entirely wanting in the posterior fragment, and perhaps the opposing teeth deficient in the upper jaw, the sling bandage, in clasping the jaws together, will force the posterior fragment higher than the anterior, thus maintaining the displacement, or even proportionally increasing it; while again, if the teeth should be complete in the posterior fragment and deficient in the anterior, the traction of the sling bandage would reverse the displacement and raise the anterior arch higher than the posterior fragment. Besides, the dressing is constantly liable to become displaced.

Many of these objections, however, do not apply to Dr. Hamilton's apparatus, which is constructed of a leather sling bandage passing beneath the chin, with a band attached to its anterior edges, which passes in front of the chin, and preventing the sling bandage from slipping back against the front of the neck, obviates the danger of drawing the anterior fragments backwards, while the sling being fixed upon the head by horizontal straps passing around the forehead and vertex, prevents the danger of the dressing becoming displaced. In cases where there are no teeth deficient at a point through which the patient may be fed, Dr. Hamilton recommends that a single gutta percha splint be laid upon the crowns of the teeth on each side, leaving an open space for admission of food in front. This apparatus commends itself to us as probably the most practicable heretofore in use, but nevertheless would, we think, be deficient in correcting the displacement in case of certain irregularities of the teeth in the superior maxilla, or in case of a fracture at the symphysis.

Wire sutures attaching the fractured surfaces have been, and are still used in some cases with a good degree of success; but where the fracture is simple and occurs far back, the sutures are difficult to apply, and in many cases excite an inflammation of the gums and increased salivation, which renders the method objectionable, or even impracticable; besides, in order to make the fracture secure, in many cases it will be necessary, in addition, to apply the sling bandage, thus clasping the jaws together so as to prevent the patient taking food.

The ligature thrown around the teeth adjacent to the fracture on either side, as practised first by Hippocrates, and subsequently by Chelius, Miller, Cooper, and others, has been very justly ignored by Malgaigne and Gibson. The method is objectionable: in the first place, because there may be no teeth to which the ligature can be attached, or if any, they may be decayed, and become painful by the pressure of the ligature; while again, the teeth frequently become loosened, and, if previously sound, are caused to decay; besides, where there is any considerable degree of displacement, the ligature is not sufficient to maintain the fracture in position without the aid of the sling bandage.

Ligatures applied in this manner almost always excite inflammation of the gums, with increased salivation.

The silver clasp invented by Dr. Mütter, consisting of a plate made so as to cover the crowns and sides of the first two teeth adjacent to the fracture on either side, is objectionable, not only on account of its expense, but the great difficulty of fitting such a plate sufficiently accurate to retain the fragments in position, which it certainly would not do where there was much displacement, without the aid of the sling bandage, as in case of the ligature attached to the teeth.

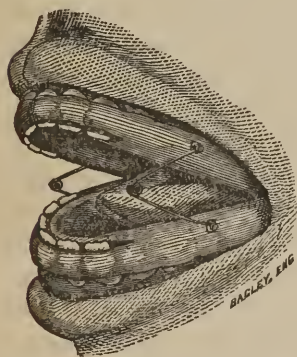
Various interdental splints have been devised for treating this fracture, as those of Fergusson and Miller, consisting of a simple piece of ivory or cork placed between the teeth, but this appliance is too unsteady and easily displaced to rely upon. Gibson, Syme and Erichsen wholly ignore the method as impracticable.

Various modifications of interdental, connected with sub-mental splints, with clamps connecting the two, have been devised for treating fractures of the jaw. The first, probably, of these was by Rutenick, in the year 1799, and consisted of a silver plate, made so as to fit the crowns and sides of the teeth adjacent to the fracture, to which hooks were attached, which passed out of the mouth, to be screwed into a wooden splint constructed so as to fit the jaw upon its external and under surface. This apparatus has been variously modified by Hauzalot, Malgaigne, Lonsdale, and others, whose success with its application is not such as to commend the method as practicable, as, in almost all the cases recorded by these gentlemen, the appliance was so painful that the patients could not endure it long; or, where it was borne for any length of time, it produced abscesses under the jaw, while Malgaigne asserts that the apparatus is constantly liable to slip forward and become displaced.

Philip S. Wales, Surgeon U. S. Navy, has more recently invented an apparatus somewhat similar to the above, consisting of a dental and sub-mental plate, made of gutta percha, with a flattened wire attached to the dental splint, and passing out of the mouth, bent over the lip at a right angle, to be inserted in a mortice in the sub-mental splint in front of the symphysis, and fixed

at a given degree of pressure by a thumb screw in the outer plate of the mortise, the sub-mental splint being fixed more firmly to the jaw by a strap passing beneath it, and buckled over the top of the head in front of the ears. This apparatus is more practical than any other of the kind with which we are familiar, from the fact that the two splints are moulded so as to fit the parts accurately, and thus correct any irregularity caused from the teeth in the inferior maxilla, while the sub-mental plate can be so accurately fitted to the external surface of the jaw that it would not be so likely to cause injury to the soft parts; though the strap passing over the top of the head for the purpose of binding the splint to the jaw is objectionable—yet unavoidable—from holding the jaws clasped together, and preventing the patient's taking food or drink.

The interdental splint which I have devised and illustrated by the following wood-cut is relieved of many disadvantages of the appliances I have just mentioned, while, at the same time it is both simple and cheap.



The two dental splints are made of vulcanized gutta percha, so as to conform accurately to the shape of the teeth in both jaws, or where there are no teeth, or some of them are wanting, to the alveoli, in such a manner as to prevent the possibility of any lateral displacement in the fragments. Where the teeth are perfect, the plates need only fit upon the crowns and side of the teeth with-

out coming in contact with the gums at all. The splints that I have used were manufactured for me by Dr. Homer Judd, a most excellent practical dentist, of this city, by the same process that an impression of the jaw is taken in plaster of Paris, for plates intended for artificial teeth. In taking the impression for the lower jaw, the plate filled with plaster being placed in position upon the teeth, both hands of the operator placed beneath the jaw, forces the fragments into position, where they are

held until the plaster becomes sufficiently firm to preserve the cast. From these casts the gutta percha splints are moulded, and subsequently vulcanized. The gutta percha thus prepared has such a degree of firmness that the plates can be made very light and delicate, allowing a part of the teeth to project through the surface of the plates, thus fixing the splints more firmly. Previous to vulcanizing the plates, four small pivots are inserted into them, two on either side, opposite the last bicuspid teeth. To these pivots the ends of the triangular spiral springs are hooked so as to admit of motion upon the pivots. These triangular springs are made of brass wire one-sixteenth of an inch in thickness, the spiral portion being formed of two turns of the wire at the anterior, angular or central portion, while the ends project backwards to the extent of an inch, to be attached to the pivots on the outer sides of the splints, so that when the plates or splints are in position, as shown in the diagram, these springs, (the spiral mouth,) force the inferior maxilla downwards, with a force proportionate to the strength of the springs.

In order to adjust the splints properly, the springs should be compressed by grasping the plates between the thumbs and fingers so as to insert them between the jaws, and place them in proper position upon the crowns of the teeth, then force the fragments into their proper position, when the inferior plate will be found to fit the jaw accurately, which it will not do until the bone is properly adjusted. After the plates and fracture are once in position, the mouth will be forced wide open by the action of the interdental springs. This is counteracted by a sling bandage passing beneath the jaw and over the top of the head, forcing the jaws in such proximity as to leave a sufficient space between them in front so as to enable the patient to take food and drink, and at the same time allow him to talk so as to be understood distinctly, while he is also enabled to expectorate without difficulty. The amount of space that will exist between the plates in front will depend upon the amount of force necessary to be used by the sling bandage, and which should be just sufficient to place the fragments in their proper axis. If the force required for this purpose should be greater than the resistance of the springs in

any given case, and force the plates in contact with each other, the springs should be removed and replaced by stronger ones. Another difficulty existing in the apparatus of Gibson and Barton is obviated in this appliance, i. e., instead of drawing the anterior fragment backwards, in which direction it is already displaced to some extent in fractures of the body of the bone, the interdental springs, when compressed by the sling bandage, have a tendency to push the anterior arch forwards. While, by keeping the inferior maxilla depressed by the force of the springs, the sub-mental muscles are in a measure relaxed, and the tendency to displacement downwards and backwards of the anterior fragment is diminished. Indeed, the principle involved in the apparatus is to substitute these two plates for the jaws, the former of which being entirely under our control by means of the interdental springs, so that just as we control the splints so do we control the jaw, while, at the same time, the force exerted is operating upon the entire surface of both maxillæ at the same time, thus adapting the apparatus to fractures occurring at any point of the jaw that can be reached by the material necessary to secure a cast of the fragments, regardless of the absence or irregularities of the teeth or the character of displacement of the fracture.

FRACTURE OF THE HEAD OF THE HUMERUS.

Every surgeon who has had much experience in treating fractures about the head of the humerus can testify to the great difficulty of maintaining the fragments in apposition, even with the most ingenious appliances, amongst which those of Desault, Sir A. Cooper, Fergusson, Erichsen, Welch, Richerard and Dupuytren, are most generally used. The very fact that the means of treating these fractures have been changed and modified by so many distinguished surgeons, is sufficient evidence of the difficulties to be encountered in adapting any apparatus to correct the deformity most usually to be found to exist in these injuries.

In speaking of fractures of the head of the humerus, I refer only to that portion of the bone above the attachment of the latissimus dorsi and pectoralis major muscles. This would embrace—external to the capsular ligament—the tubercles and

surgical neck, in the latter of which fractures most frequently occur from direct violence; yet fractures not unfrequently occur through the tubercles from the same cause, and in both cases, there is always more or less displacement, where the fracture is complete and not impacted. Fractures of the anatomical neck are not so often attended with displacement, or shortening, but even here it is not uncommon, from the great violence required to produce the fracture, to find the capsular ligament ruptured, and one or both fragments displaced. In all cases of fracture occurring outside of the capsule, where there is no impaction, there must be more or less displacement of the upper fragment from the contraction of the muscles attached about the tubercles. It is on this account that none of the appliances in ordinary use, such as pads in the axilla, and cap splints over the point of the shoulder, can be made effectual in maintaining the bones in apposition; because it is impossible to place any kind of compress in the axilla, that can be brought to bear upon the upper fragment, without producing an amount of pressure on the axillary vessels intolerable to the patient, while it would be a rare and peculiar fracture that could be kept in apposition, where the upper fragment and muscles attached to it, were allowed to go unrestrained, even though the shaft of the humerus might be maintained in its proper axis by the use of a pad in the axilla.

Where there is shortening of the limb, as is almost invariably the case in fractures at the surgical neck, none of these appliances could have the least influence in correcting such deformity, further than that the pressure from the bandages might control the contraction of the muscles.

In fracture of the anatomical neck, with laceration of the capsular ligament attended with displacement, the pad in the axilla would be likely to increase the deformity, and it certainly could in no wise correct it.

The accompanying woodcut represents a method I have employed which is not open to the above objections. The appliance consists merely of two strips of adhesive plaster about three inches in width, applied to the internal and external surface of the arm as high as the upperpart of the middle third of the hu-

merus. These strips are bound to the arm by a roller bandage, and at their lower end, beneath the point of the elbow, are attached to a cord, to which a sand-bag is attached, weighing ordinarily, from three to four pounds.

This sand-bag, as represented in the diagram, is attached close to the point of the elbow when the patient wishes to walk about, by knotting the cord by which it is suspended, and when he lies in bed, the knot in the cord as seen in the cut, is loosed, and the cord carried beneath the bed-clothing over a small pulley placed at the foot of the bed, and in this way an equal extension is constantly kept up, whether the patient is confined to his bed or is able and prefers to walk about.



When using this apparatus for treating these fractures, I apply no other dressing, and entirely ignore the compress in the axilla, as useless, if not positively injurious when the upper end of the the lower fragment is displaced outwards. The constant traction upon the muscles soon exhausts their tonicity, so that they allow the fragments to fall into their natural position, while the extension being constantly in the line of the axis of the humerus, it is quite impossible that any displacement should continue, either laterally or of an angular character, or that any shortening should result.

I have treated several cases of fracture of the head of the humerus on this plan, and with uniform good results. The first patient on whom I applied the dressing—and which illustrates sufficiently the progress of the cases treated subsequently,—was a stout muscular man, aged thirty-three years, who had fallen

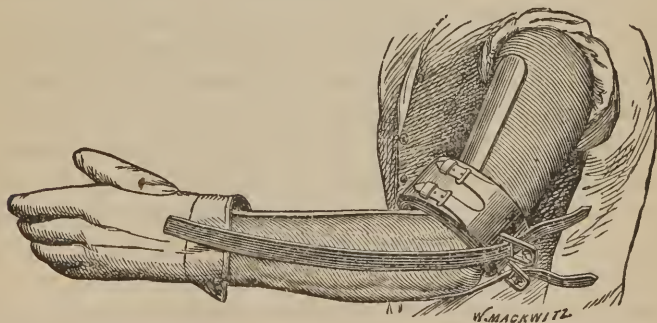
some twelve feet, striking the point of the shoulder upon the ground, causing considerable contusion of the soft parts, besides the fracture, which was considerably displaced, by the lower fragment projecting outward; there was also shortening to the extent of three-fourths of an inch. The patient complained of constant and severe pain at the point of the fracture until the third day, when the above apparatus was applied, with the effect of relieving the pain almost instantly. At the end of seven weeks the dressing was removed and the union in the fracture found to be firm, without any displacement or shortening, and in ten days after, the patient was discharged from the hospital with perfect use of his arm.

FRACTURES OF THE OLECRANON.

It is not our intention to enter into a consideration of the different portions of the olecranon at which fracture may occur; or to call attention in detail to the symptoms present when the fracture has occurred. With the latter every member of the Society is presumed to be familiar, and with reference to the former, whether the fracture be at the base, centre or extremity, the indications for treatment are the same—to bring the detached fragment in apposition with the shaft of the bone and there retain it until union has taken place. For this purpose various means have been resorted to by different surgeons, but all in our opinion are more or less objectionable or inefficient. That perhaps in most general use is the application of strips of cotton or other cloth around the arm, above and below the elbow—as recommended by Sir Astley Cooper and Amesbury—and their approximation by means of lateral strips, with the view of drawing down by this means the upper fragment and maintaining it in apposition. But when the fracture occurs at the base or middle of the process, as it most usually does, the degree of displacement is such—especially in muscular persons—that the force required to counteract effectually the retracting force of the triceps would necessarily so tighten these bands around the arm as to arrest the circulation. The danger from

this source will also be more imminent—indeed, we think, almost unavoidable—in cases in which there is much contusion and swelling of the soft parts, a condition which, as might be expected from the nature of the force or violence necessary to produce this fracture, is almost always present. The recommendation of these gentlemen that the arm be kept in the straight position, is, we think, also objectionable, being less comfortable to the patient, and securing a less perfect apposition of the fragments, than the slightly flexed position, recommended and practiced by Desault and Camper. Indeed, we have found all the ordinary appliances in use, and recommended for the treatment of this class of fractures, so deficient in meeting the indications required that we were led to devise the apparatus illustrated by the accompanying wood-cut, with which we have now treated a number of cases with uniform satisfactory results.

The apparatus, which is so simple as to require but little description, consists of a band of ordinary sole leather about three inches in width, and of sufficient length to surround the arm, lined with cloth or chamois, and well padded with cotton or hair. In order to give the band additional firmness, and also to secure it around the arm, a strip of common harness leather is stitched upon the outside, to one end of which two small buckles are attached, while the other end, which extends about three inches beyond the band, is split or cut into two straps to correspond with, and fasten into the buckles. The band is fastened around the arm above the fractured process, and may be drawn to a degree of tightness necessary to bring the broken



fragment down, when traction is made upon it, without, on account of the width of the band and the firmness and uniformity of the pressure exerted, materially affecting the circulation.

On the outer side of this band, projecting from it at right angles, and about one inch apart, either two buckles or staples, about two inches in length and three-fourths of an inch in width, are firmly and securely fastened. These buckles or staples also have three bars across them, with two tongues, one on the first and the other on the third bar, made to turn either way; or as a more simple and economical device, two notched spikes may be substituted for the staples, over which the straps, presently to be referred to, may be fastened. The same band may be used on either arm, and may be adapted to an arm of any size.

In applying this apparatus, the arm should be flexed at an angle of forty-five degrees, and a common pasteboard splint, bent at that angle, placed upon its anterior surface. The leather band is then buckled over this splint, just above the fragment of the olecranon, in such manner that one of the staples or spikes, if the latter be used, shall be on either side of it. A common buckskin glove is then placed upon the hand, to the anterior and posterior surfaces of which are attached two leather straps, which are to be buckled into the staples on the band, or fastened over the spikes if they are used. By buckling these straps over the bars at a greater or less distance from the band, or securing them upon the notches on the spikes at a greater or less distance from the band, and tightening them as required, we obtain the necessary amount of leverage to turn the lower edge of the band in upon the arm, and push the fractured process down before it; and by making traction upon these straps, any degree of force may be exerted upon the band, necessary to draw the broken fragment down and hold it in perfect apposition with the head of the ulna. The entire arm and fore-arm, including the straps, is covered with a bandage to hold the anterior splint firm to the arm, and thus prevent any movement of the elbow-joint, which, if allowed, would be constantly modifying the force exerted upon the fracture.

It may be objected to this method of treatment, that the arm

is held in a flexed position, thus increasing the space between the two fragments. But the advantage of this position is apparent for two reasons:

First, by flexing the arm to this extent the point of the olecranon is made more prominent, and, consequently, the band more surely adjusted, so as not to slip over it; while, again, the force exerted upon the band by the straps, directed at an angle of forty-five degrees upon the axis of the humerus, renders the pressure still more secure above the point of the olecranon and prevents the possibility of it slipping back beneath the band.

The second reason for fixing the arm in this position is to relax the brachialis anticus muscle, the action of which, in cases where the fracture occurs low down, near the base of the olecranon, and especially in a muscular subject, when the arm is held in a perfectly straight position, evidently draws the head of the ulna forward, so that a portion of its fractured surface is in direct apposition with the articular surface of the lower end of the humerus, when if the detached fragment of the olecranon be forced down to its proper position, it would not be in complete apposition with the upper end of the ulna, but would leave a triangular space in the articulation to be filled up by callous and thus produce more or less complete ankylosis of the joint.

This apparatus, when applied as described, is in no way painful to the patient, the band being padded on the inside, and the pressure exerted by it on the anterior surface of the arm bearing upon the pasteboard splint; the only other pressure exercised is directly upon the olecranon, and that upon such a broad surface, that sloughing need not occur in any case.

As stated, I have treated a number of cases with this apparatus, with a uniformly satisfactory result, but the following, complicated as it was, with an abscess over the seat of the fracture, will be sufficient to illustrate the advantages of the appliance, over the other methods of treatment hitherto in use.

A laboring man, aged 32 years, was admitted to hospital five days after receiving a fracture of the olecranon near the base. At the time of his admission he had an abscess as large as a hen's egg immediately over the point of the olecranon, resulting from

a contusion received when the bone was fractured. The abscess was opened before the dressing was applied, and, notwithstanding all the pressure required to hold the bones in apposition was made upon the point over the abscess, it healed quite readily, and in seven weeks the apparatus was removed, leaving firm, bony union in the fracture, without the least deformity or displacement; and now—three weeks since—the patient has recovered almost perfect use of his arm.

No passive motion of the joint was allowed at any period of the treatment.

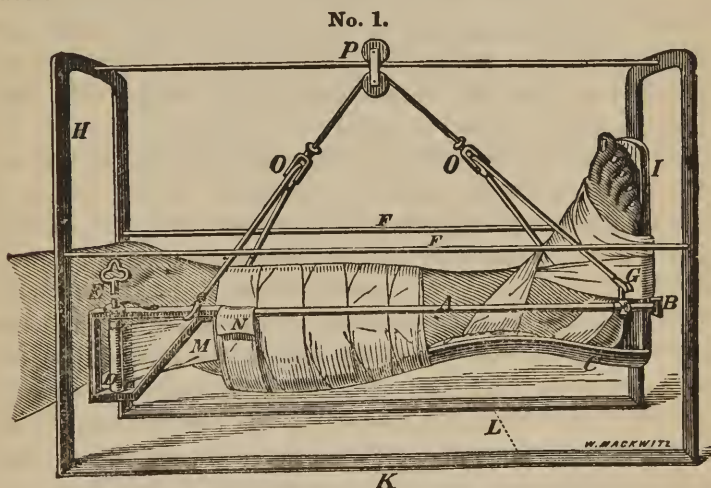
FRACTURES OF THE LEG.

In referring to the subject of fractures of the leg, it is scarcely necessary that I should allude to the causes and varieties of displacement that most usually occur, or that I should mention all the appliances and methods of treatment in popular use for the relief of this class of injuries, as I presume every gentleman present is familiar with these details. I shall, therefore, only mention the apparatus I have devised for that purpose, and which is not so generally known.

The great necessity for a well-adapted apparatus in treating fractures of the leg, suggested the utility of the instrument I have designed in the following woodcut, which not only answers every practical purpose in treating this class of fractures, but also contributes very much to the comfort of the patient, who, while he is enabled to execute every movement of which the sound limb is capable, yet cannot displace the fracture or modify the force of extension. In presenting this apparatus, I claim for it an advantage over those invented by Hutchinson, John Neill, Crandall and Salter, not only as a means of extension and counter-extension, but also in its adaptation to the treatment of compound fractures of the leg, as represented in figure No. 2; and I feel confident that its simplicity, its cheapness, and its applicability to every variety of fractures of the leg, will certainly ensure it the precedence with all who may give it a trial in a single case.

The apparatus is such as may be made by any blacksmith, or indeed by any ingenious surgeon in a case of necessity, as a wooden frame and two hoops with a common iron pulley may be made to answer quite as well as the instrument which I have had made of iron on the following plan :

The two arches, represented by the letter (H) at one end, are made of iron bars one-eighth of an inch in thickness, and three-fourths of an inch in width, and are continuous with the bottom pieces (K), which rest upon the bed and measure twenty-two inches in length. The arches are also supported on the sides by the two slender bars or rods (F.F), while the bar supporting them at the top, upon which the pulley (P) glides, should be made flat, with the long diameter vertical, and of sufficient strength to prevent it bending with the weight of the leg. The width of the arches, as indicated by the letter (L), should be fifteen inches, and their height eighteen inches from the surface of the bed.



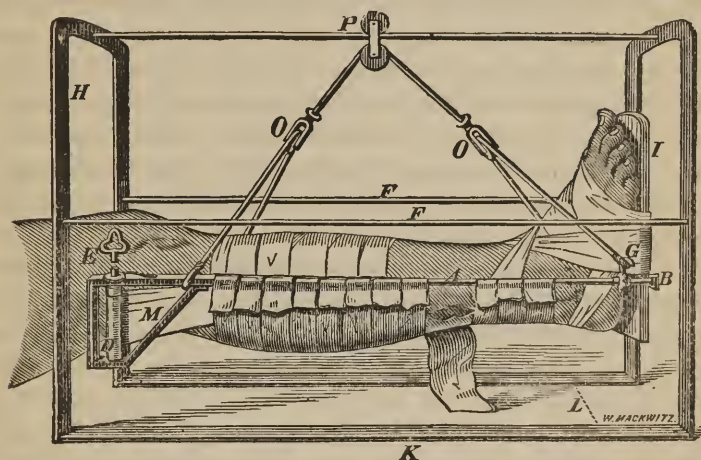
This description will be sufficient to indicate the proportions of the exterior apparatus.

The bars (A) of the frame or portion of the apparatus in which the leg is suspended, should be about two feet in length—unless when the fracture is so close to the knee that it may be

necessary to attach the adhesive straps (M) above the knee, when the bars may extend to near the perineum if necessary—and the crossbar passing beneath the foot-piece (I), and upon which the foot-piece rests by means of a suitable hook or bracket (B), should be flattened, the more readily and securely to engage in the hook or bracket, and be five inches in length, so as to allow ample space for the limb to rest between the bars; the space between these bars at the upper end should ordinarily be about six inches. The splint (C) upon which the leg rests in figure No. 1, should be concave upon its upper surface and conform to the shape of the leg, and should also be made oval upon its under surface, so that both the leg and the splint may be included in the bandage, as shown in figure No. 1, by which means any displacement may be corrected in the fracture and the bones kept in perfect apposition. The foot piece (I) should be attached to the posterior splint at an obtuse angle, so as to correspond with the natural position of the foot. The foot is bound to this piece by adhesive straps, which may embrace the whole of the foot, and extend partially over the ankle, but not so as to arrest the circulation, as by the figure-of-eight bandage formerly used around the ankle for making extension. The leg then, as seen in figure No. 1, is supported upon the crossbar passing under the bracket (B) attached to the foot-piece, and by resting upon the strap (N), pinned over the bars (A) on either side, while the extension and counter-extension is effected by means of the cross bar and hook or bracket attached to the foot-piece below, and adhesive straps (M) above, three inches in width, which are attached to the sides of the leg, beginning just above the point of fracture and passing up to be wound around the cylinder (D), which is three and-a-half inches in length, is turned by means of an ordinary clock key (E), and is held in any position to which it may be turned, by a ratchet and wheel placed upon the upper surface of the bar, as indicated in the diagram.

It will be observed in figure No. 2, that there is no posterior splint as in the other diagram, but that the leg is supported entirely by strips of muslin pinned over the bars on either side, ren-

dering the apparatus more appropriate for the treatment of compound fractures, as the wound may be examined and dressed when necessary, by removing one or more of these strips, which may be replaced by new ones without disturbing the fracture. The attachment of the foot-piece in this dressing does not in any particular differ from that of figure No. 1, and the method of suspension is the same in both these dressings. By means of the pulley at the letter (P), the patient is enabled to move



his limb, or even his body, forward and back to the extent of the length of the bar upon which it glides; and by means of the cord playing over the under wheel in the same pulley, the patient is able (when the fracture is not so near the knee as to necessitate the apparatus extending above the knee) by a very slight effort, to flex or extend the knee by depressing or elevating the foot, while at the same time he can swing the leg from side to side to any extent within the space of the arches; and by means of the cords playing through the pulleys at (O,O), the leg can be rotated to any extent, even to allow the patient to lie upon his side if he desires, without disturbing the fracture in the least. It will be observed in the diagrams that at the letter (G) there is a thimble, which can be made to slide upon the bar, by means of which—sliding this thimble

forward or back, and fixing it at any point by means of the little thumb-screw attached to the thimble—the lower end of the leg can be elevated or depressed at the will of the patient.

In developing the utility of this apparatus for the treatment of fractures of the leg, I have tried various means of attaching the foot to the foot-piece, such as muslin and flannel bandages in the form of a figure of eight around the ankle, covering the foot also, as far as the toes, but have always found them objectionable from the great amount of pressure and consequent arrest of circulation in the foot; though the flannel bandage is much less objectionable than the muslin. But I have been able to obviate this objection by the use of the adhesive plaster attached over the front of the foot, and around the foot-piece, as shown in the diagram, which I have always found quite sufficient to secure the position of the foot. I have, during the past three years, treated a large number of cases of fractures of the leg with this apparatus, in which both bones were fractured, and in which there was more or less shortening in each case, with excellent results in all of them, without allowing the least deformity or shortening, while the patients were all grateful for the comforts afforded them by this apparatus during their confinement.

The above apparatus, as represented in plate No. 2, is also admirably adapted to the treatment of fractures of the fibula at the usual point, in which there is eversion of the foot, or partial dislocation of the ankle joint outwards. By attaching the foot, with adhesive strips, to a foot-board about one inch narrower than the space between the two bars of the iron splint at the lower end, and then inserting a wedge on the outer side of the foot-piece, so as to force the ankle in close to the inner bar, and passing a strip of muslin, three or four inches in width, around the inner side of the lower third of the leg and tying it tightly around the external bar of the splint, the leg is thus drawn outward by the band, while the foot is forced inwards by the wedge, and the displacement entirely corrected. The leg is then suspended as in other fractures occurring in its shaft.

FRACTURES OF THE FEMUR.

The character of the displacements usually occurring in fractures of the shaft of the femur, as well as the causes which produce them, are too familiar to every surgeon to require detailed description. We shall therefore only allude to some of the appliances best adapted to the treatment of this class of fractures. But since many of the older appliances are still in general use for the purposes of making extension and correcting the deformity, we shall first point out the defects in these before noticing the more recent improved methods of treatment.

The long splint of Desault and Physic has perhaps been more generally used than any other during the past half century, and at the time it was first introduced, it was doubtless a great improvement upon the former method of treating this fracture; yet, its defects are now so conspicuous as to be obvious to every surgeon of experience. The excoriating perineal band is not only cruel and painful to the patient, but also unreliable in maintaining a permanent degree of extension, unless frequently tightened, and to such an extent as to exert an amount of pressure upon the perineum that can hardly be tolerated by the patient. This splint is also objectionable from the fact that it confines the patient to a single fixed position in the bed and admits of no motion in the limb during the entire application, which in many cases is a most decided objection, as where there is any serious complication, constitutional or otherwise, or in case of bed-sores, the consideration and treatment of either of which are often of quite as much importance as the fracture itself, and the latter especially, may be avoided, or in a great measure remedied, by such appliances as will admit of the patient changing his position in bed.

The starch bandage has also been much used, especially in English hospitals, in recent fractures of the femur, and from the statements of Mr. Erichsen, of King's College Hospital, it would seem with very good results. But it does not appear possible that in an oblique fracture of the femur in muscular subjects, in which there is almost invariably a considerable degree of short-

ening, that a sufficient amount of extension could be maintained with this appliance to preserve the proper length of the limb. And again, if the patient is allowed to go about on crutches as recommended by Mr. Erichsen, there would seem to be increased danger of displacement, and consequent deformity in a fracture thus encased and concealed in a stiff bandage, which is liable to become loosened from the combined effects of the absorption of inflammatory exudation, and muscular atrophy from disuse of the limb.

Were it not for these objections, the appliance is very commendable, inasmuch as it does not confine the patient either to his bed or his room, thus placing him in the very best general condition for securing union in the fracture. In fact all fixed dressings that confine the patient to one position in the bed, are objectionable, however well they may meet all the other indications, the comfort and sustaining the general health of the patient being of paramount importance. Even the method of extension by means of the sand-bag, while it readily corrects the shortening, and will maintain the proper length of the limb, is objectionable, as usually applied with the limb fixed upon the bed, for the reasons above stated.

Perhaps the first move in the right direction towards the treatment of fractures of the femur, was by Professor N. R. Smith, of Baltimore, in the application of his suspension splints as represented in cuts No. 1 and 2—since imitated by Professor John T. Hodgen, of this city.

PLATE NO. 1.

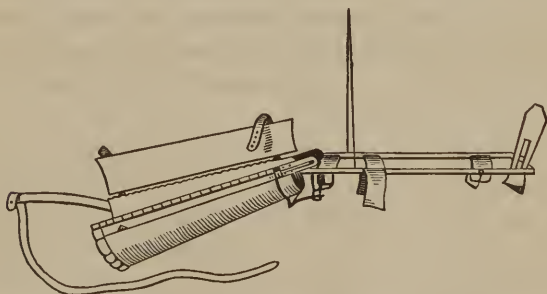
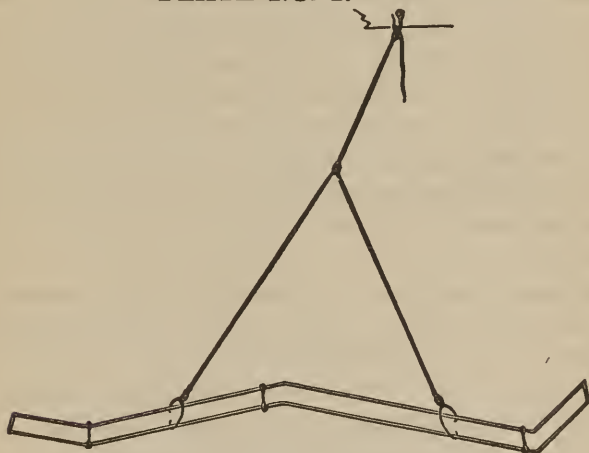


Plate No. 1 represents Professor Smith's "Double Inclined

Plane," which consists of a rod of iron wire, of sufficient length, so bent upon itself as to form bars extending upon either side of the limb, from the pelvis to a point beyond the foot, as seen in the diagram. The two bars are then connected from the knee up, by a tin trough upon which the posterior surface of the thigh rests. A similar shaped cap is attached upon the anterior surface of the splint and fastened down upon the thigh in front, by means of straps and buckles. Below the knee, the leg rests upon strips of cloth or webbing attached over the bars on either side, and the foot is attached to the foot-piece, by means of a roller bandage. The limb is then suspended from the ceiling so as to elevate it clear of the bed and admit of its position being changed.

Professor Smith has also a modification of this appliance called his "Anterior Splint," which is represented in Plate No. 2.

PLATE NO. 2.



SMITH'S ANTERIOR SPLINT—WITH SUSPENSION.

In this splint, the bars of wire are closer together, so that they lie upon the anterior surface of the limb, and are bound down by a roller bandage extending from the foot to the perineum, the limb then being suspended by cords attached to the bars above and below the knee and extending to the ceiling.

These splints, although meeting a very important indication

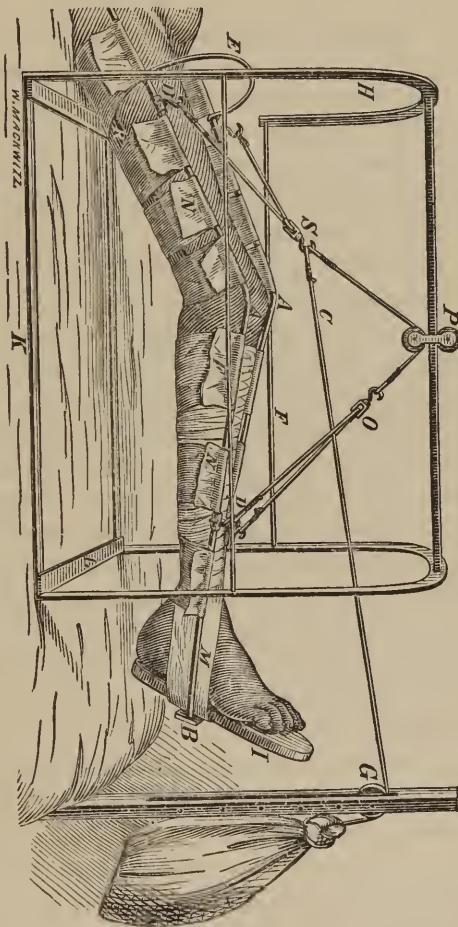
in the treatment of this fracture, by suspending the limb, are yet defective in the method of extension, which depends upon the degree of obliquity at which the cord ascends to the ceiling, and hence the force of the extension is modified by every movement of the patient up or down in the bed. The character of the extending force, or rather the manner in which it is thus made, is such, that, with the known tendency or disposition of the patient to slip down in the bed, he will do so if he is not interrupted, until he approaches a point perpendicular to the attachment of the suspension cord at the ceiling, when the extension ceases almost entirely; or if not allowed to reach that point, the extension is constantly being diminished as he moves down in the bed, which he is certain to do, even though the foot of the bed be elevated. Suppose in order to maintain a direct extension of twelve pounds, that the cord should be attached to the ceiling at an angle of 40° from a let-fall; suppose then that the patient slides down in bed, which he will do in less than twenty-four hours, until this angle is diminished to 35° , or even after a longer time to 30° , then one-eighth or one-fourth of the extending force will have been lost entirely. And again to be compelled so frequently to replace the patient by drawing him up in bed, necessitates more or less motion in the fracture by the constantly varying extension, as also unavoidable alternate contraction and relaxation of the muscles.

After some experience in the use of a splint, combining the principles of Prof. Smith's double inclined plane and the method of suspension shown in connection with his anterior splint, (cut No. 2), known as "Hodgen's Wire Suspension Splint," and realizing the inconveniences and defects above referred to, I devised an improvement in the method of suspension and extension which entirely obviates these disadvantages.

This apparatus, as represented in the accompanying wood-cut, No. 3, needs but little description to indicate the manner of its application. The arch and pulleys upon which the limb is suspended are exactly the same as those of my splint for treating fracture of the leg, as already described. The arch should be made of iron bars one-eighth of an inch in thickness and half

an inch in width. The top of the arch (H) should stand eighteen inches from the surface of the bed; the width of the frame at

PLATE NO. 3.



the bottom (L) should be fifteen inches, and its length (K), twenty-four inches. The two arches are braced upon each other by the slender bars (F F), at either side, and the rail at the top upon which the pulley (P) glides. This rail, to prevent bending,

should be made of steel, three-eighths of an inch in width and one-fourth of an inch in thickness, with its broad diameter placed in the vertical position, and should have a thumb-screw at one end, so that it may be withdrawn to apply the pulley. It will be observed that the arch at the proximal end is cut away at the inner side, immediately below where it joins the lateral bar (F), the object of which is, to allow the patient to use the other limb more freely. The frame or splint upon which the limb is mounted—like that of Smith's "double inclined plane,"—consists of iron rods (A A), one-fourth of an inch in thickness, placed parallel on both sides of the limb, extending its whole length and transversely across below the foot. The limb is then adjusted in the splint by placing it in position and pinning strips of bandage (N N) four or five inches in width over the bars on either side, constituting the floor of the splint, upon which the limb is allowed to rest in the suspended position, instead of the tin trough on the thigh part of Smith's splint, but similar to the strips pinned across the leg portion, and probably first used by German surgeons. To this is added, however, as will be seen in the diagram at (R), a sheet of heavy pasteboard five inches in width, extending from the nates to the knee, upon the posterior surface of the thigh, thus giving a more equable support to the limb at the point of fracture. These bars, upon which the limb is supported, are prevented from approaching too near to each other or to the limb, by the wire bow (E), holding them in position at their upper extremities.

The attachment for extension is by means of adhesive strips (M), extending from near the knee and passing around the foot-piece (I), to which is attached a small bracket (B), which hooks over the lower end of the splint. Then the limb is suspended by the four hooks (D D), which are attached to thimbles that slide back and forth upon the bars, and are fixed at the desired point by means of thumb-screws in their outer sides. The limb now being suspended, the extension is made by means of the cord (C), attached to the hook in the pulley at (S), which passes forward between the cords playing over the pulley at (O), and is carried over the pulley (G), fixed in the slender post at the

foot of the bed, and then attached to a sand-bag of sufficient weight to make the necessary amount of extension. The weight ordinarily required for an adult is from ten to fifteen pounds. With the limb thus adjusted in the apparatus the axis of the femur may be changed to any line that may be desired by sliding the thimbles nearest the foot forwards or back, which will elevate or depress the leg, and in doing so will produce just the opposite effect in the position of the thigh. Or again, the same can be accomplished by sliding the thimbles at the thigh back or forward. Or, the axis of the femur may be still more conveniently adjusted by sliding the pulley (P), back or forth upon the suspension rail. The pulley being drawn towards the body, will have the effect of elevating the thigh and depressing the foot, and *vice versa*. Then by means of the lateral movement afforded by the pulleys (S, O), the patient is enabled to rotate the limb sufficiently to allow him to lie upon his side, if it becomes necessary, without producing any displacement.

The only counter-extension required with this dressing is the weight of the body, which is quite sufficient in all cases; for even though the patient should gradually slip down in bed, the extension is constantly the same until his foot reaches the post at the foot of the bed, when, without any assistance, he can draw himself up in bed again, the whole apparatus connected with the limb coming back with the pulley (P) upon the suspension rail, when the body is drawn upwards. While, again, by placing the frame at such a distance from the foot of the bed that the patient's foot cannot reach the post sustaining the pulley (G), it is impossible that the permanent extension should be at all interrupted or changed by any movement or change of position the patient may make.

Thus it will be seen that the patient is enabled to execute many movements of which the sound limb is capable, without in any way modifying the force of the extension, or changing the axis of the femur. Even though the patient desires to sit up, or lie upon his side, as he is often compelled to do because of bed-sores, or other injuries upon his back, or for the evacuation of his bowels, the position of the fracture is not in the least affected or union retarded.

It has been urged, and may be thought by some, as an objection to this plan of treating fractures of the femur by suspension, that the great degree of motion allowed to the limb, will admit of too much mobility in the fracture. But such objections are altogether theoretical, for it must be apparent, as experience has proven, that with any ordinary movement of the limb, the motion will take place where there is the least resistance, which would of course be at the joint, and not at the point of fracture. It will readily be seen that as the weight of the limb is supported as much upon the upper as upon the lower fragment, and the entire limb carried alike in every movement, the whole length of the thigh being supported upon the sheet of pasteboard on the floor of the splint, it is impossible for any motion to take place at the point of fracture without direct force being exerted for this purpose. This apparatus is also peculiarly adapted to compound fractures of the femur, as the limb, not being encumbered by bandages or splints, is always exposed to view, and the necessary dressings can be conveniently applied without at all interfering with the apposition of the fragments, and the strips of bandage beneath, upon which the limb is supported, can be readily removed when they become soiled, and replaced with fresh ones, without in the least disturbing the position of the limb.

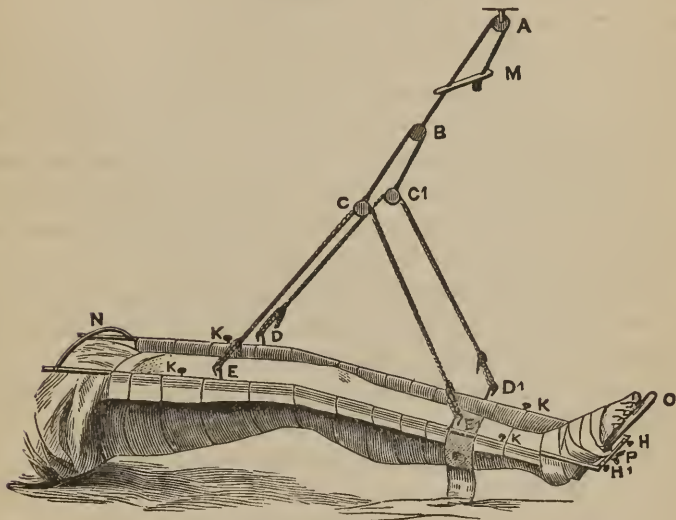
I have during the past three years, treated a large number of fractures with this apparatus, with better results, and less discomfort to the patient, than I have secured from any other appliance.

When I first published a description of my splint for treating fracture of the femur, in the *Medical Archives* for October, 1868, I had not seen Professor Smith's "Double Inclined Plane," but was familiar with the "Hodgen's Wire Suspension Splint," then in use in the St. Louis City Hospital, and it was my experience with the defects of this splint that led me to devise the combination represented in Fig. 3. Believing at the time that the splint was really the invention of Dr. Hodgen, as claimed by him, I announced my splint as the "Improved Hodgen Splint," but I now embrace this opportunity to correct this error and also the

injustice done Professor Smith in giving to another the credit of his invention.

The fact that Dr. Hodgen's splint—as seen in Plate No. 4.

PLATE NO. 4.



is an exact imitation of Smith's "Double Inclined Plane" and his "Anterior Splint," as seen in Plates 1 and 2, is apparent by a glance at the diagrams. Take the suspension cords from Plate No. 2, and attach them to plate No. 1, and we have Hodgen's wire suspension splint, except that Hodgen continues the slips of cloth up to the nates instead of the sheet of tin from the knee up—this means of supporting the limb being a German method, and not Hodgen's, as I then supposed. Dr. Hodgen has also probably added the lateral pulleys, but which differ from those of my splint in that they only admit of flexion and extension or an antero-posterior motion.

FRACTURES OF THE PATELLA.

It is well known to every surgeon, that even transverse fractures of the patella may occur, where the ligament is not ruptured, without any displacement in the fracture. In the case of

vertical fracture of this bone, as sometimes occurs, there is not ordinarily any displacement necessary to be corrected by mechanical appliances. In this paper, therefore, we shall only allude to that form of transverse fracture attended with displacement of the upper fragment, and requiring mechanical appliances for its coaptation.

It seems strange that until the past few years, the appliances ordinarily resorted to, in the treatment of this fracture, have been either cruel and severe, or inefficient in securing the desired result, while if we are to credit the statement of prominent men in the profession, the best and most popular apparatus used at the present day had been used twenty years since and fallen into disuse from some unknown cause. But the careless manner and inefficient means with which some surgeons treat this fracture, may grow out of a prevailing opinion with some, that the union secured between the fragments is never of bony material, but always fibro-cartilaginous, even when the fractured surfaces are in perfect co-aptation, and that hence it is not absolutely necessary that the displaced fragment should be forced down into perfect apposition. But this opinion is evidently wrong. Many surgeons have observed cases in which the fragments, having been held in apposition, the callous presented satisfactory evidence of having become ossified; while recorded specimens, taken from the cadaver—one of which was reported by Dr. P. S. O'Reilly, of this city,* in which the fragments had been maintained in close apposition, and the union found to be as well organized as the bone itself—demonstrate the fact conclusively. But even though we should fail to secure bony union in some cases under the most favorable circumstances, it is none the less the duty of the surgeon to co-apt the fragments as nearly as possible, and endeavor thus to retain them by the most perfect means at his command. For this purpose various appliances have been devised—as the torturing hooks of Malgaingne, so long and so generally used; the two half rings invented by the late Mr. Lonsdale; the method of drawing the fragments

*No. 1, Volume IV., of the Medical Archives, January, 1870.

down by means of strips placed above and below the fragments, and crossing at the sides to be attached to hooks in a posterior splint, as proposed by Mr. Wood, of King's College; and the method of Sir A. Cooper, which consists in fastening a band around the thigh, above the upper fragment, and drawing it down by means of lateral strips placed upon either side of the leg and passing around the bottom of the foot;—all of which are objectionable in cases where the displacement is considerable, from the fact of their inefficiency, or if made efficient, they exert such a degree of pressure upon the limb, that the patient is not likely to tolerate them a sufficient length of time to secure union in the fracture. These objections, however, do not apply to the method of treatment by the ring, as more recently proposed by Dr. W. A. Gibson, of this city.*

The ring, as recommended by Dr. Gibson, is made of iron, about three-eighths of an inch in thickness, and sufficiently large, after being padded, to embrace the patella closely, all the fragments being gathered within the ring, which is then retained in position by attaching a strap or band on either side, and fastening around a wooden splint, laid upon the posterior surface of the leg and thigh, the splint being retained in position by a roller bandage, thus preventing any motion of the knee-joint. This simple method of treating this troublesome fracture is certainly worthy of commendation, and entitled to rank superior to every other means now or ever in use. Through the courtesy of Dr. Gibson, I had an opportunity of seeing the first case he treated with the ring, which was a complete transverse fracture of the patella, occurring in a rheumatic patient, from muscular contraction. In this case, the patient wore the ring for thirty days, when it was removed and passive motion commenced. The final result was all that could have been desired; the fracture united by bony union, and the strength of the limb was perfectly restored.

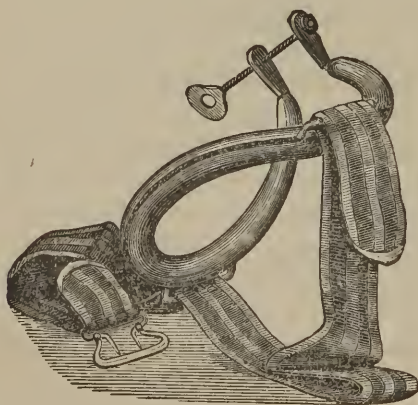
Professor Paul F. Eve, of Nashville, also reported two cases thus treated successfully by him, immediately after the publica-

* St. Louis Medical Journal, September, 1867.

tion of Dr. Gibson's case. Professor Eve was so gratified with the result in his cases, that he says: "A moment's reflection will convince medical men, that of all means proposed to retain the fragments of a fractured patella in contact, and thus promote bony union, instead of the ligamentous one usually obtained in practice, the ring must have great and decided advantage, and is so simple in application, that the thought almost involuntarily arises, "Why was it not suggested sooner?" Professor Eve suggests that the ring should be worn for some time after the union seems to be quite firm. This precaution may be well enough as a means of preventing a separation of the fragments until the callous becomes perfectly ossified.

I have also treated two cases of fracture of the patella by this simple method, and with entirely satisfactory results, securing bony union, as I am satisfied, in both cases.

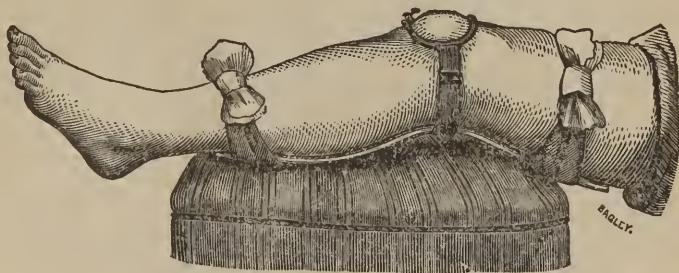
Dr. P. S. O'Reilly, of this city, has during the past year devised an appliance, illustrated by the accompanying wood cut,



O'REILLY'S RING.

which he claims possesses advantages over the more simple ring used by Dr. Gibson. Dr. O'Reilly's description of it is as follows: "It consists of a piece of round tempered steel, and, as may be observed from the illustration, is of an oval, horse-shoe shape, with the ends turned in and bent upward. The sides de-

pressed so that the part corresponding with the toe of the [horse] shoe, is curved upward to the extent of about half an inch, allowing it to ride over and upon the ligament of the rectus muscle, while the sides dip down and embrace the bone, and at the same time, by pressure at the insertion of the *evasti muscles* it counteracts the action of the latter muscles; and yet it does not, by undue pressure upon the tendon of the rectus, cause the fragment to tilt up at the point of fracture, as must necessarily result when the pressure is made on this tendon alone, as done by the simple ring. On the sides slightly anterior to a line through the centre of the oval or horse-shoe part, are fixed ears or loops for the reception of the band by which the *shoe portion* of the splint is held in position. Through the turned ends of that portion corresponding with the heel or calk of the horse-shoe, is a thumb-screw, by which the splint is compressed, or expanded, as may be required. The splint being covered with chamois, or soft felt and a strap of silk or linen webbing, or smooth leather, with a buckle on one end, made to pass through one of the ears, renders it complete for application. The injured limb being laid upon one of Day's covered posterior splints, well padded, and a little wider than the leg, secured at each end by a handkerchief or roller bandage, the fragments being brought into position, the *Patella Splint* is placed over and made to encircle



O'REILLEY'S RING APPLIED.

them, the strap carried under the leg and around the Day's splint and run through the opposite loop or ear, is returned upon itself, and buckled sufficiently tight to keep the splint in posi-

tion, but not so as to inconvenience the patient more than the case demands. By the thumb-screw the splint may be tightened or relaxed as circumstances may require."

This modification may possess some advantages in certain cases, especially that it can be adapted to a patella of any size, thus avoiding the inconvenience of procuring different sized rings when needed; besides there may be some cases where it can be more accurately adapted to the patella than the simple ring. As I have only had an opportunity to use Dr. O'Reilly's ring in one case, I have not had sufficient experience in its use to determine what peculiar advantages it may possess over the ordinary ring; though in the case in which I used it, the result was very satisfactory; the fragments were held in good position, and the callus, I am confident, became perfectly ossified, while the patient complained of no pain from the pressure of the ring during the treatment. The modification is certainly an ingenious one, and reflects much credit upon the inventor.

To whom the credit is due of first proposing this method of treating fracture of the patella with a ring, seems to be a question not well determined. Since our best text books on surgery make no allusion to it, we might be led to suppose that it probably originated with Dr. Gibson; but since the publication of Dr. Gibson's case, other gentlemen claim to have applied the same principle many years prior. Prof. J. V. Z. Blaney, of Chicago, informed me that he had treated fracture of the patella, twenty years ago, by cutting a *fœnestrum* in a piece of sole leather, the opening being sufficiently large to fit the patella accurately, just as the ring is now adapted. Dr. Henry Mussey, of Cincinnati, also states that he treated fractures of the patella as early as 1856, in the same manner as Professor Blaney, except that he used *gutta percha* instead of leather. I am also recently informed that the late Dr. J. N. McDowell stated before his death, that he treated a fracture of the patella, some twenty years ago with the ring of a trace chain.

Now, it seems to be a most remarkable circumstance, that the principle of this method should have been thought of so many years ago, and practised by so many gentlemen, and then have

fallen into disuse and been forgotten until revived by Dr. Gibson. If it were a complicated apparatus or difficult to apply, and its results often unsatisfactory, then we should not have been surprised that it had been neglected and forgotten. But that an appliance so cheap, so simple, and so easy of application, and so universally successful in its results, as to excite the query in the mind of every surgeon, "why it was not thought of before," could have fallen so entirely into neglect and disuse as to be forgotten, and not even have found mention in any of our text books, seems indeed remarkable. But it matters not who may be entitled to the priority of this invention, it is certainly true, as stated by Dr. Gibson, that he had no knowledge of the principle ever having been put in practice before, and is therefore, entitled to all the credit of the original inventor.





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